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The consolidation of Electrical World, Electrical Engineer and American Electrician

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Telling the Folks at Home

A RECENTLY adopted policy offers the contributors to the ELECTRICAL WORLD and the companies of whose activities they write a new service of unusually interesting character. Our Newspaper Service Bureau now sends brief items to the local papers "back home" telling of the appearance in the ELECTRICAL WORLD of articles involving the activities of the men, utilities and industries in their territory.

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The readiness with which the newspapers have accepted the initial releases indicates the acceptance of the value and interest of the plan by the local press.

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*NOTE—The most important of these methods will be described in subsequent advertisements.

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 91 — *New York, Saturday, January 14, 1928* — NUMBER 2

Era of Electrification at Hand

AMERICAN railroads have come back. They have survived the attempt at governmental operation, a period of inadequate rates and years in which their credit and their business were in the doldrums. Railroad executives had the courage to overcome heavy obstacles, and national thanks are due them for their remarkable achievements.

The end is not yet, for in a recent statement General W. W. Atterbury pointed out many things which should be done to better transportation and make it more economical. Among these he put electrification, and well-founded rumors presage a major electrification program for the Pennsylvania Railroad in the near future. Other railroads are also ready for electrification in that several systems have worked out a fundamental plan and analysis to show where and when electrification is warranted. The Illinois Central terminal electrification in Chicago is going to be followed by other terminal electrifications because published results of electric operations in Chicago are convincing.

Not all railroad lines should be electrified. But heavy-traffic terminals in large cities, heavy-traffic main lines and lines with steep grades are prospects for electrification over which the electrical industry can keep busy for several years. Energy will be purchased from light and power systems in most cases, and the requirement of automatic train control makes it necessary to revise signal and structural arrangements on all railroads so that electrical overhead systems will be readily installed. The time is ripe for a major electrification program.

* * * * *

Creation of Markets Opens Engineers' Fields

ENGINEERS, as distinguished from scientists and technicians, justify their profession to the extent that they apply science to economic and social needs. In so doing they will enhance civilization as measured by the extent to which people enjoy happiness and can adapt themselves to the conditions of the time.

Particularly of late, there has been wider recognition of the fact that engineers must consider not only technical problems but economical organization or administration, finance and production. Each is essential, but a warning must be sounded not to make a fetish of organization, which is only a skeleton or framework into which individual human effort must be fitted. Through the recent revolution in financing methods every man on the street has become a capitalist, making corporate and public relations the concern of all. Production is the foundation of wealth and civilization, so that a community will enjoy both only as the average individual contribution of effort is high. Therefore engineers will do well to think of their mission in life as one to increase the productivity of their fellow men through scientific applications rather than to magnify the means to the end.

Even though our country affords the proof that substituting mechanical slaves for human slaves has brought the average laboring man the highest standard of living existent anywhere, some nations are being held back industrially and socially because of labor's belief there that increasing the productivity per worker through machinery will permanently displace workers. Obviously, there will be no work for those displaced unless something has been done to increase the need for workers. This something has involved increasing the demand for products and the development of new products through research. Merchandising, therefore, is an all-important activity which engineers must add to the already recognized factors influencing engineering development. Without an outlet for things produced or service made available, there is little need for production, and hence the engineer. There is no danger of "overselling" the American public so long as the productivity per worker is increased and thus the ability to augment his income.

* * * *

Governor Smith's Futile Water-Power Program

GOVERNOR SMITH in his annual message to the Legislature of New York made an admirable presentation of his accomplishments as the chief executive of the Empire State. As a report of work done and hopes deferred the Governor's message merits commendation. That many of his recommendations have come to naught is not indicative of any lack of sincerity on his part, but of the fact that the Legislature has had a different view. In a measure it is well that this has been so, because some of Governor Smith's recommendations indicate a socialistic rather than a democratic tendency, and the plausibility with which he presents and argues for them makes them all the more insidious. For example, his recommendation for a state Water Power Authority empowered to use its own securities against the proved economic value of state water-power development is unsound and reveals the politician rather than the statesman. There is a tendency toward a super-government in the shape of "authorities," which apparently owe no responsibility to the people or to the Legislature and some of which are not even performing the work for which they were created.

The Port Authority, to cite one notable example, was appointed to wrestle with the port problem. To date it has done absolutely nothing along that line, but has taken up work like bridge building, which, however laudable, was never contemplated in the original legislation, and it has issued securities for that purpose at very low rates because people believe that the credit of the state

is back of them. This is contrary to the fact. The proposed Water Power Authority would add to the existing bureaus, and although it might not have power to assess those benefited, as do the river control authorities, it would nevertheless be able to float securities on proposals which might conceivably be of questionable merit, for how can one prove the economic value of water-power development not in existence?

In addition, the Governor proposes to rob the Public Service Commission of some authority, because the Water Power Authority would have full control of rate regulation and of other problems arising in connection with state ownership and state control of water power. Further encroachment on state regulation is suggested by permitting localities to fix rates for public utility services within their borders. These are blemishes on an otherwise admirable record and it is fortunate for the public as well as for the public utilities operating in the state that the Legislature has not heretofore seen eye to eye with Governor Smith concerning these ideas. As a matter of practical politics also there is little likelihood of the present Republican Legislature passing many of the proposed measures or in any other way giving aid or comfort to a Democratic Governor with presidential aspirations.

* * * *

Efficient Service and Satisfied Personnel

LABOR rarely has been a subject of controversy in the electric light and power industry. This has been so chiefly because the industry does not require much labor in the manufacture of its product and also because it realizes that efficient electric service largely depends upon a satisfied and efficient personnel. It is vain to expect alert, courteous, conscientious and willing service from employees inadequately paid or whose faithfulness to duty is unappreciated or unrecognized. Public utility service is vital to home, community and industrial life, and wherever possible every effort should be made to make that service better and more reliable. Adequate wages are, of course, essential; but faithful and intelligent effort is entitled to something more. The first may be demanded as a matter of right; the second will not be withheld by a wise management.

There are in existence among electric public utility and manufacturing companies many plans for improving employee relationships. Some involve pensions, others profit sharing, and still others employee partnership. One of the most successful plans is that followed by the Brooklyn Edison Company. In 1910 that company adopted a system of sharing its profits with its employees, and it has followed it ever since. More than half a million dollars was voted for that purpose recently. every employee who has served the company faithfully for two years receives, in addition to his regular pay, a percentage of his salary, depending on length of service, ranging from one-quarter to the full dividend rate paid on the capital stock. This is invested in the securities of the company, and as a result the Brooklyn Edison Investment Fund held, at the end of 1926, 2,338 shares of stock and $722,000 in bonds for the benefit of 5,200 employees. In addition, 1,100 employees individually owned 8,779 shares of stock, making a total of 11,117 shares of stock held either directly by or for the benefit of employees.

There are, of course, other ways of obtaining and holding the loyalty of employees which are just as democratic and effective in building up esprit de corps. Indeed, the Brooklyn Edison Company itself shows its interest in its employees' welfare in many other ways. The essential feature of any plan, however, must be a frank and just recognition of diligence and faithfulness on the part of employees, with no suggestion of condescension or paternalism. Employees should be able to feel that they can make public service their life's work. It is a great tribute to the management of any company to be free from labor troubles, but it is a much greater accomplishment to possess a satisfied, loyal, enthusiastic and willing organization, and such an organization management may obtain if it merits it.

* * * *

Intangibles in Purchasing

AS THE art of electrical design develops, intangible factors assume greater importance to the discriminating buyer, be he a representative of the industry or a customer of one of its branches. In the machinery and apparatus fields the purchasing agent is considering many other points besides price, and slowly the general public is coming to realize that other elements than first cost ought to be weighed in sales transactions. It is a handicap that no common unit of measurement is available in dealing with many of the indefinite factors which influence buying, but an approach is being made by the use of the point system in balancing intangibles after the arithmetical elements in competitive bids have been listed and analyzed.

The point system has the advantage of being simple to apply, although the values obtained by its use are likely to vary widely among buyers. Individual judgment largely determines the weight given in specific cases to such items as the reputation of the manufacturer, the amount of previous experience the buyer or others in the industry have had with the product offered, the probable life of the equipment or commodity in question, value of accessibility, safety aspects, absence, or presence of fire risk, effect on the contentment, welfare and efficiency of employees, appearance of the design, and adaptability to further improvements. This is not as serious an obstacle. to intelligent purchasing as might appear on the surface. The personal equation of the buyer affects the prorating of points, but such prorating can be made virtually free from bias where the purchasing agent is untrammeled by his superiors and accustomed to attacking the buying problem in a scientific manner.

In other words, a fair comparison can be made on the point system of even extremely elusive factors bearing upon the selection of a particular commodity or service, just as essays are evaluated point by point in prize competitions decided by committees working first as individuals and then in camera. In harmonizing individual interpretations of intangible value into unanimous or majority group action, as in discussing bids in a conference attended by the purchasing agent, engineering staff representatives and executives, it is only necessary to agree upon the number of points to be accorded to particular items and then to eliminate as fast as possible items valued alike or approximately alike by those in session, following with items in dispute. Upon final vote the last item in disagreement should be disposed of and the docket cleared for a fair decision taking into account all known elements in the purchase task.

Outdoor Advertising a Revenue-Builder

ELECTRICAL advertising contributes about 4 per cent of the gross revenue which central-station companies receive from lighting in this country. This amounts to nearly forty million dollars, or to about one month's residence lighting bill. When we think of electrical outdoor advertising, the spectacular sign comes to mind and the bulletin and poster boards remain in the background. The latter are less spectacular, but they greatly predominate in the field. Even now the illuminated board contributes more revenue than the spectacular electric sign. It has the advantage of smaller cost and greater flexibility. The so-called electric sign is largely a night-shift worker. The illuminated bulletin board works two shifts—day and night—and its low cost makes it possible for it to invade many communities where the spectacular sign cannot be justified economically.

The revenue-building possibilities of bulletin boards are found in various directions. A large percentage of them are not illuminated and therefore are not working when they can be most effective. An illuminated board has high value as an attractor of attention because it stands out relatively alone. The distracting and competitive surroundings and background are largely lost in darkness. Then there is the matter of intensity of illumination. Contrast is of primary importance in obtaining attention. By increasing the amount of light the contrast is increased, and the speed of vision is likewise favorably affected.

Finally, there is a great field of development in the use of artificial light sources and lighting to add touches of the so-called electric sign to the illuminated board. The running border of light sources has already arrived. Trademarks and other devices may be emphasized by transparencies or by light sources. Silhouette letters and many other devices besides floodlighting are available. Complete effective development of the bulletin board is still to come. It is a logical movement which will bring to each locality electrical advertising in which economic considerations and visual appeal are justifiably blended.

* * * *

The Metermen's Goal

THE extensive adoption of the four-wire, three-phase system of distribution, whether primary or secondary, has brought with it a number of problems for the meterman, as the choice of the proper meter to use on this system cannot be decided without considerable investigation of what equipment is available and what is best suited to the conditions. In the case of the Memphis Power & Light Company, where a large four-wire, three-phase network system is in operation, all of the possible schemes of metering received consideration. The final choice, as pointed out in an article elsewhere in this issue, was made on the most expensive method in so far as first cost is concerned. The reasons can all be given in one word—accuracy. It is the first consideration of a meterman. Of course he must consider the cost, but it never pays to sacrifice real accuracy for a small saving of investment cost.

As an indication of what modern metering requirements are, a case may be quoted from one utility that supplies a customer with 18,000 kw. at a high load factor and with a high power factor. The metering is done at 44,000 volts and is somewhat complicated because of the necessity of totalizing the power used on two feeders and measuring the maximum simultaneous kilovolt-ampere demand. The customer rather seriously questioned the accuracy of the equipment that was being used and finally spent about $6,000 purchasing and installing entirely independent equipment to meter the consumption by a different method and with apparatus of a make different from that used by the utility. The latter's equipment was in nowise disturbed. At the end of a week's operation the customer' meter showed 0.15 per cent less power than the utility's meter. The customer had been looking for a difference of from 12 per cent to 15 per cent. Such accuracy is not always secured, but a difference of less than 1 per cent between metering equipments can certainly be consistently secured by proper metering methods.

* * * *

Commercial Versus Theoretical Research

RESEARCH has become a necessary auxiliary to management and operation in the industrial organism. More than a thousand companies have research divisions, 70 trade associations spend about $15,000,000 a year in research, 152 colleges spend about $1,500,000 for the same purpose, and several government departments participate. About $200,000,000 annually is now spent for research in this country. Electrical men have contributed greatly to the cause. Their industry is fortunate in that it deals with a new science which can be put to work only by the use of imagination and precision measurements. They have learned by experience that research is a profitable commercial activity and that it acts as the key to market supremacy. As a consequence research is an established auxiliary in all branches of the industry.

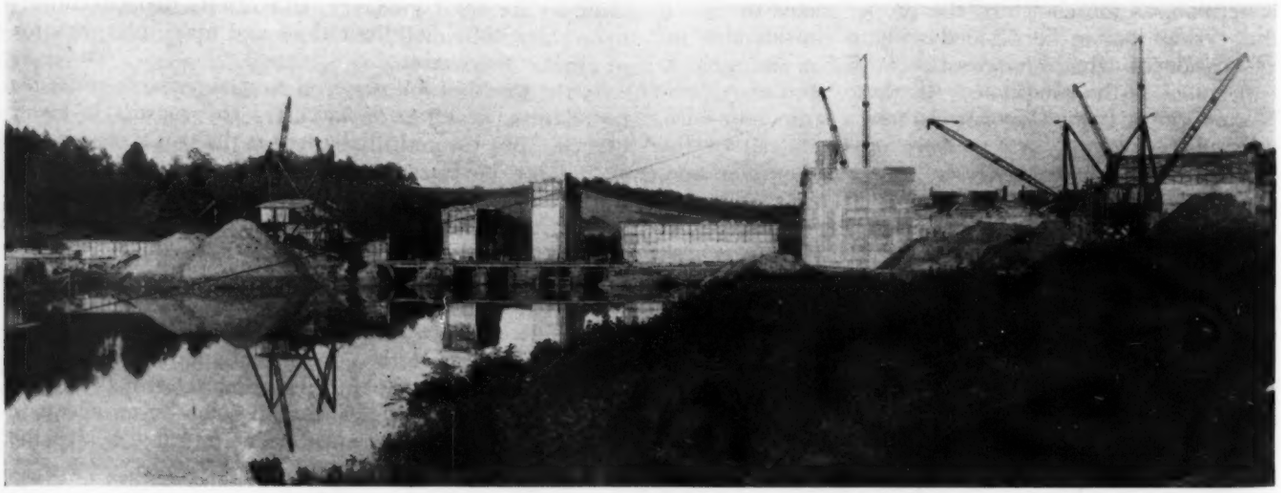
Commercial research should be divorced from theoretical research. They mix like oil and water. Commercial research should be tied directly to production and market objectives and must measure itself in dollars and in other commercial values. This class of research requires men who know manufacture and marketing as well as science. Their work must be focused on visualized objectives in the factories and on the properties. But general theoretical research should have no commercial ties. It is a job for scientists who sit on top of a mountain and try to pierce the unknown in every direction. These men are fact finders through the application of principles. Only general fields of science may be outlined for their guidance, and results depend entirely upon their individual limitations and upon interpretation of chance discoveries.

In the world of industry commercial research is needed by all groups and is an auxiliary to progress in every branch. But theoretical research is the true research and should not be placed second in any industry program. Each business should support some commercial research as part of its activities, but in addition industry should support theoretical researches. In the colleges an admirable atmosphere for the growth of this type of research exists, but they are too poor to do the tasks, and frequently they are too busy teaching to be concerned with research. Both the government and industry should study the research situation in order to provide means to place pure or theoretical investigation on an adequate basis. It only has permanent value and it deserves the utmost in co-operative support.

Oxford Shoals Plant

of the Southern Power System Nearing Completion

THE 45,000-kva. hydro-electric development of the Duke (formerly Southern) Power Company on the Catawba River between the existing Rhodhiss and Mountain Island plants will probably be placed in operation next April. On Nov. 1 about 100,000 cu.yd. of concrete had been poured out of the total required (200 000 cu.yd.) and 80 per cent of the total excavation (more than 100,000 cu.yd.) had been completed. The dam is 1,600 ft. long and the normal operating head will be 90 ft. The power-house structure will contain two 22,500-kva. generators and their corresponding 6,600/110,000-volt transformers installed as a unit. Switching will be performed on the high-tension side of the transformers.



Unit-type Pulverizers Used in Kalamazoo Plant

New Michigan power house combines excellence in design with speed in construction. First use of powdered fuel by Consumers Company is unit type. Turbine bleeding in fullest use

By J. W. MACKENZIE and W. E. JACOBS
Consumers Power Company, Jackson, Mich.

THE placing in operation of the new Kalamazoo steam plant of the Consumers Power Company on June 1, 1927, was marked with special interest by the members of that company and others not only because it was the first venture of the company in pulverized-fuel operation but also because it represented a new high standard, at least for that company, in the way of rapid plant construction. To build a 20,000-kw. plant, including foundations, between Oct. 1 and June 1 meant a very unusual construction period. Early deliveries became an important part of all contracts. The closest possible co-operation among the designing engineers, the construction department and the operating department was necessary in order that decisions might be reached early and plans scheduled in such a way as to deliver to the construction department all drawings in the order in which they were required for work. On the evening of June 1, 1927, the turbine was synchronized on the line and took its share of the system load.

FACTORS DETERMINING STATION DESIGN

The site of the new Kalamazoo plant was decided upon because the load studies of the system showed that additional capacity was required in this portion of the state. Also, sufficient transmission line facilities were already in service to take care of any excess power at this point. Railway service and an adequate supply of water for condensing operation were available here. The location of a plant at this site, together with three transmission lines, would insure the greatest possible reliability of service to the city of Kalamazoo. The company already owned the necessary property, and as there was a small plant at this location, it would not be necessary to provide an entirely new plant organization.

The other steam plants of the Consumers Power Company are stoker-fired, but in the design of this plant it was decided to use pulverized fuel for the following reasons:

1. In view of the results obtained from pulverized fuel in other companies, it was decided that this company should get some definite information of its own on this subject, and as the Kalamazoo plant would be built for its ultimate capacity, anything that was done in this plant would not commit the company in future design.

2. The present plants of the company were all equipped with underfeed stokers and furnaces arranged to use only high-grade West Virginia coal, and although it is possible to design this equipment for burning lower-grade coals, the present stokers do not adapt themselves readily to the use of Ohio, Indiana or Michigan coals. Accordingly it was thought that by designing the Kalamazoo plant for pulverized-fuel operation it would be possible to use some of the low-grade coals at such times as the coal market made their use economical.

3. Since this plant would have a single generating unit, it was possible to bleed the high stages of the turbine for feed-water heating without the complications that exist where more than one turbine is used. This made the use of economizers undesirable, and the installations of a high boiler and an air preheater without economizers would result in preheating the air to temperatures higher than was thought desirable to use with underfeed stokers. It will be noted from the cross-section, and also from the piping diagram that this plant is extremely simple to operate. A boiler pressure of 400 lb. was decided upon, because the standards for this pressure were well established, and although it was realized that efficiences would not be so good as in plants utilizing higher pressures or a reheat cycle, it was felt that, with a plant of this size and character of loading, these added complications could not be justified.

The generating equipment consists of a 20,000-kw., bleeder-type, three-phase, 60-cycle turbo-generator, which feeds directly to the 5,000-volt bus from which all distribution circuits are taken. Any generation not required for the local load is taken from the main bus through three sets of transformers to the 40,000-volt and 140,000-volt transmission systems.

FULL TURBINE BLEEDING USED

The turbine receives steam at 350 lb. gage and 725 deg. F. total temperature. It is a fourteen-stage impulse machine arranged for bleeding from the fourth, seventh and eleventh stages for furnishing steam to operate a make-up water evaporator and to heat the feed water. The turbine exhausts into a two-pass surface condenser of 25,000 sq.ft. cooling surface, 23,500 sq.ft. of which is in the main condenser and 1,500 sq.ft. in an external air cooler. The condenser is equipped with a set of steam ejectors, which consists of two primary and two secondary jets together with inter- and after-condenser units for condensing the steam of the jets, condensate from the main unit being used for this purpose.

An underground concrete duct takes water from the Kalamazoo River after it has passed through traveling screens, which are installed in a separate screen house

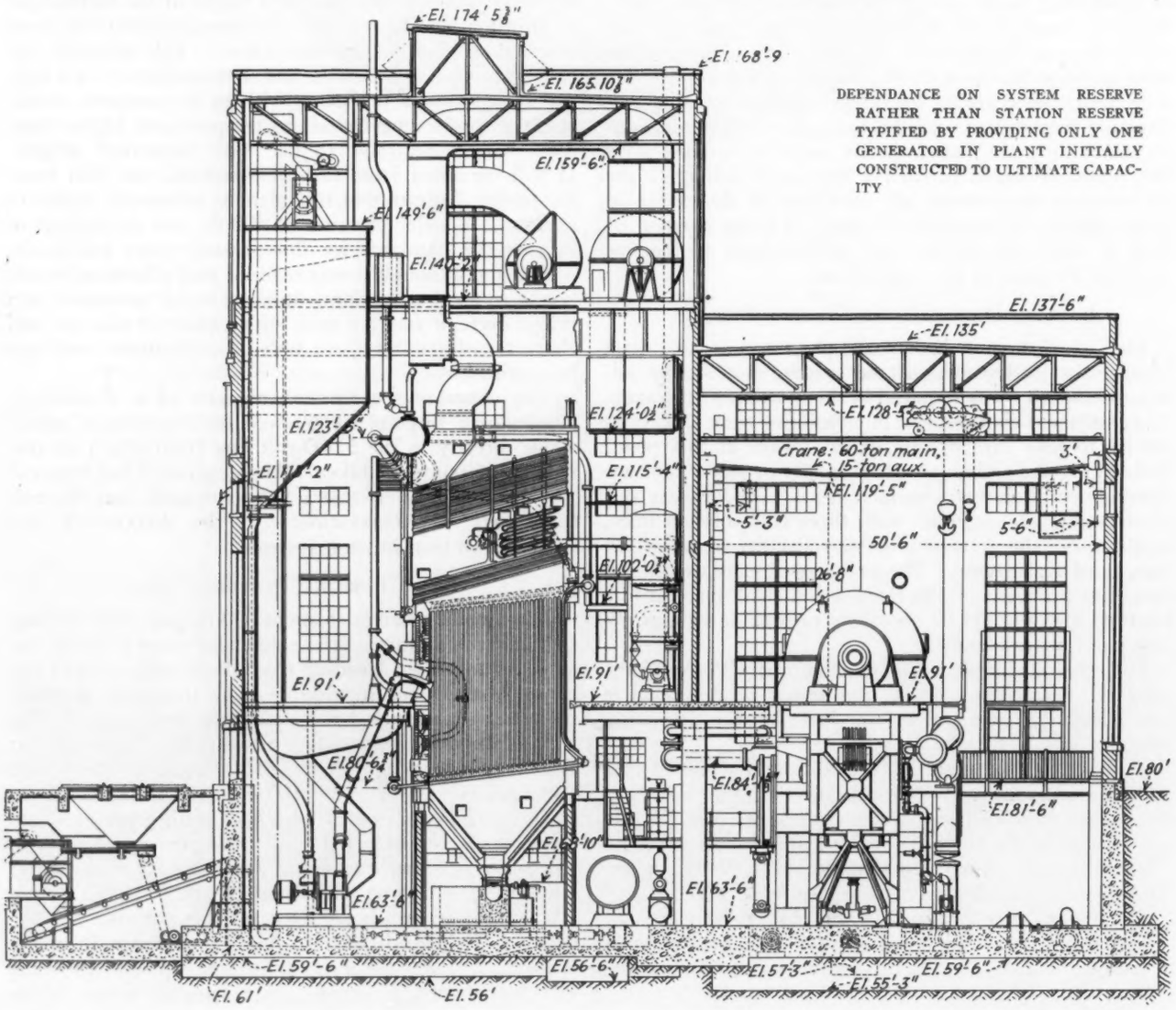
located about 130 ft. from the plant, and conducts the water to the plant for condenser cooling and for the plant raw water service. The circulating water is supplied by either or both of two centrifugal pumps of 15,500-gal.-per-minute capacity each, which are driven by 440-volt, 125-hp., constant-speed alterating-current motors direct connected to the pumps. These pumps are located in the turbine room basement and below river level.

The condensate from the main unit is handled by either of two 600-gal.-per-minute centrifugal hot well pumps driven by constant-speed alternating-current motors. The condensate passes through the ejector condensers and then through the eleventh stage bleeder heater to the boiler-feed pumps. From these pumps it passes in turn through the seventh and fourth stage heaters to the main boiler-feed header. Any heater may be bypassed and cut out of service, and in case of emergency the boiler-feed pumps can discharge directly into the auxiliary boiler-feed header without passing through the seventh or fourth stage heaters. Normally the water is fed into one end of the boiler drum through a single feed line fitted with a Venturi meter, a constant differential pressure control valve and a Copes boiler-feed regulator, or in emergencies, it may be fed by hand control through an auxiliary line into the other end of the boiler drum.

To assure de-aëration of the condensate, the condenser is equipped with a special type of hot well guaranteed to reduce the dissolved gases in the water to below the danger point. In order that the make-up may also be free from oxygen and corrosive gases, special arrangement is made for taking the make-up water from an outside pure water storage tank and spraying it into the top of the condenser. A surge tank is located in the top of the boiler room and is connected to the boiler-feed header. When the level in this tank falls below a safe working level, a float-controlled regulator opens a valve in the line from the storage tank to the condenser and make-up is drawn into the condenser by the vacuum. If the level in the surge tank rises nearly to the point of overflowing, the float-controlled mechanism opens a valve in a line joining the discharge of the condensate pumps with the outside storage and some of the condensate is pumped into the outside tank.

The boiler-feed pump equipment consists of two six-stage motor-driven and one four-stage turbine-driven centrifugal pumps, each designed to deliver 600 gal.-per-minute at a total head of 1,185 ft. with a positive head of 35 ft. on the suction. The motors are 440-volt, 1,150-r.p.m., 300-hp., constant-speed alternating-current, motors, and the turbine is a 300-hp. non-condensing turbine operating at 2,400 r.p.m. The turbine-driven pump is held as a spare for immediate service in case of trouble with the motor-driven pumps.

The fourth stage of the turbine is bled to furnish steam



DEPENDANCE ON SYSTEM RESERVE RATHER THAN STATION RESERVE TYPIFIED BY PROVIDING ONLY ONE GENERATOR IN PLANT INITIALLY CONSTRUCTED TO ULTIMATE CAPACITY

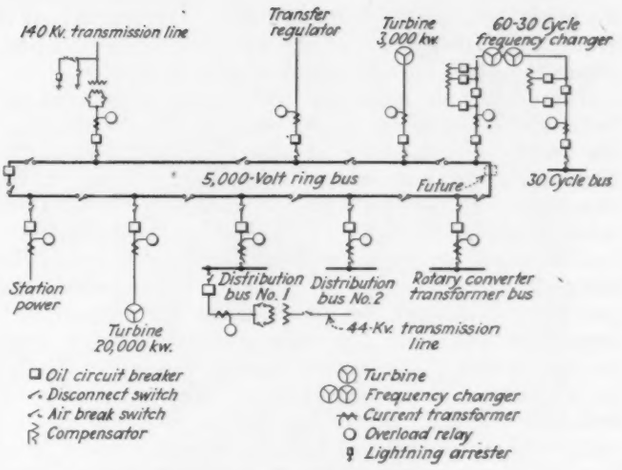
for heating the feed water in the high-pressure heater and for the evaporator. This heater, as well as the intermediate or seventh stage heater, is of the floating-head closed type built for 150 lb. steam pressure and 600 lb. water pressure. The drips from this heater are trapped into the intermediate or seventh-stage heater.

The evaporator is of the single-effect submerged-coil type, having a capacity of 12,000 lb. per hour. The vapor is piped into the seventh-stage heater, as is also the coil drain. The raw-water supply is obtained from an open heater and is pumped into the evaporator by means of a 50 gal. per minute motor-driven centrifugal pump through a float-controlled valve, which maintains a constant level in the evaporator shell. The open heater receives exhaust steam from the reciprocating house-service pump and also from the steam-driven boiler-feed pump when it is in operation.

The eleventh stage heater receives the drips from the seventh-stage heater and steam from the turbine bleeder and passes its drips into a small motor-driven hot well pump, which discharges into the boiler-feed pump suction header. In case the drip pump is out of service, the drips can be passed through a 15-ft. sealing loop into the hot well of the main condenser. Each heater is vented into the heater next lower in pressure or all of the heaters may be vented into the main condenser.

The boiler equipment consists of three 1,536-hp. cross-drum boilers designed for 400 lb. working steam pressure, which are set so as to be fired under the downtake end. The boilers are 24 section (two tubes per section) in width and are twenty tubes high, fourteen rows above and six rows below an intercheck superheater. One tube in each of the four bottom rows in each section is omitted, thus forming a slag screen to prevent slag bridging across the bottom tubes annd restricting the gas passage through the first pass. The omission of these tubes makes it the equivalent of a standard eighteen-tube high boiler. The boilers are baffled so as to make three passes, the horizontal baffle being above the lower deck of tubes, thus exposing the entire deck to radiant heat from the furnace.

In addition to the boiler heating surface, the side and rear walls consist of fin tube water-cooled surface, and a

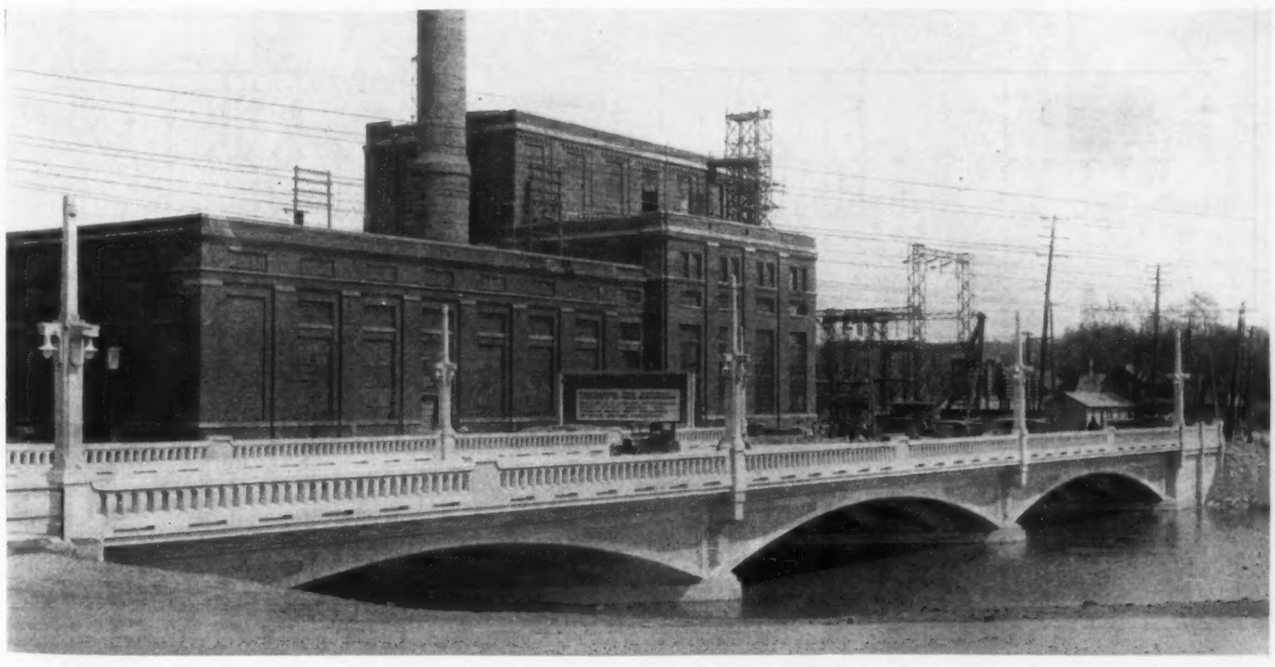


MAIN STATION BUS ARRANGEMENT

Lopulco type water screen is provided across the bottom of the furnace to prevent clinkering of the ash. The total water-cooled surface around the furnace is approximately 1,770 sq.ft., all of which is a connection into the boiler circulation, thus giving a boiler unit having 17,130 sq.ft. of heating surface.

Above each boiler is a large plate-type air preheater with 21,600 sq.ft. of effective heating surface and having 150 elements, the plates of which are 16 ft. high and 5 ft. wide, both air and gas passages being $\frac{1}{2}$ in. in width. It is expected that this preheater will reduce the flue gas temperature below 300 deg. F. at the normal boiler ratings and will preheat the air to about 425 deg. F.

The coal-pulverizing equipment consists of two four-ton per hour capacity Type 5-A Simplex unit pulverizers per boiler located on the boiler room basement floor. The mills are driven by 440-volt, 100-hp., constant-speed alternating-current motors operating at about 1,150 r.p.m. The fans on the end of the mill shaft draw about 800 cu.ft. of air per minute through the mill and about 12,000 cu.ft. per minute from the hot air duct, the two streams of air joining at the discharge of the mill and constituting



KALAMAZOO PLANT OF CONSUMERS POWER COMPANY

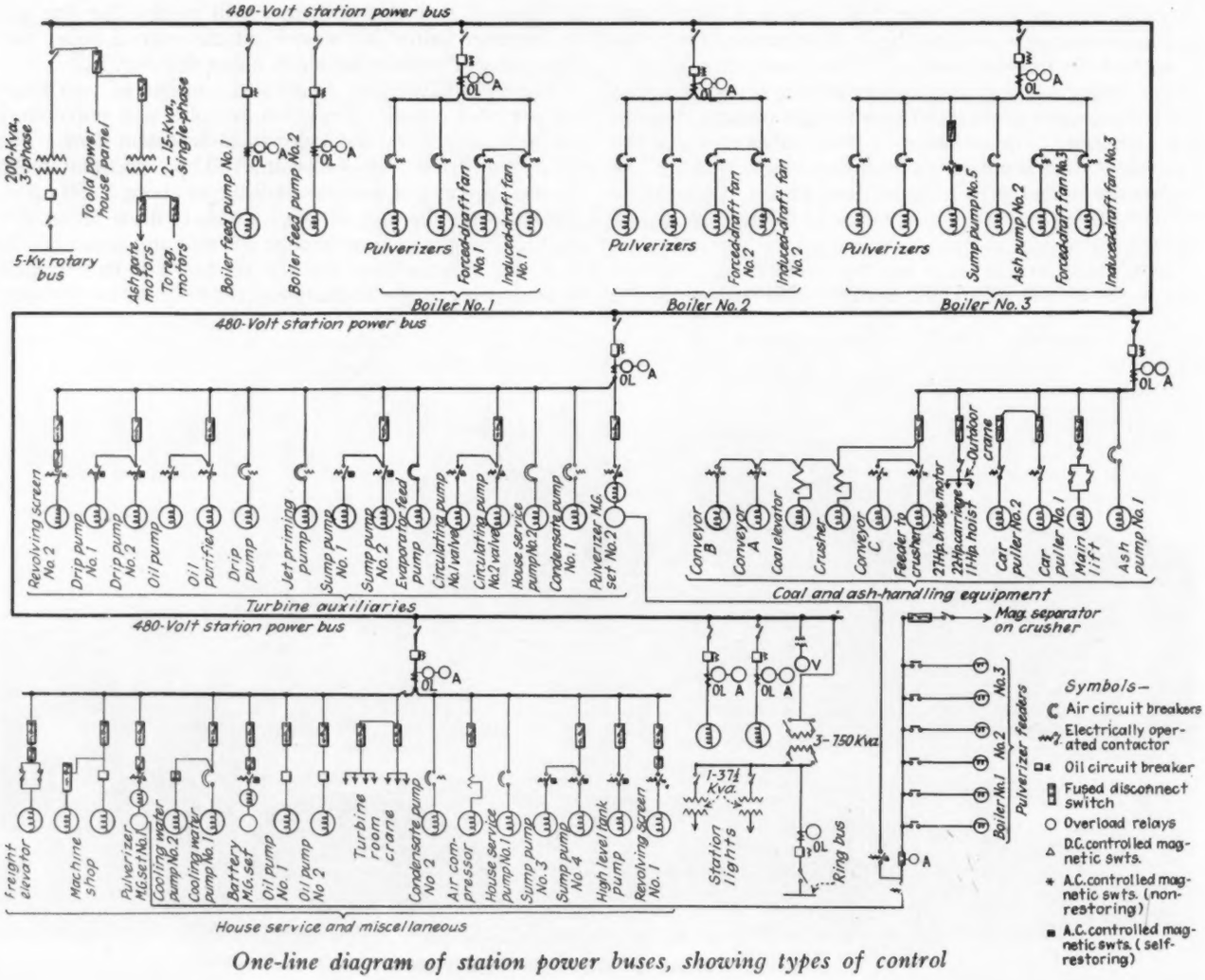
the primary air supply to the burners. The primary air is from 35 to 70 per cent of the total air for combustion, depending upon the amount of coal being burned.

There are four horizontal turbulent-type burners per boiler located in the front wall of each furnace just above the boiler room floor and arranged with the axis of the burners inclined downward 20 deg. from the horizontal, two burners to each pulverizer. Each boiler is equipped with individual forced and induced-draft fans, which are located on the air preheater floor above the boilers. The forced draft fans take air from the top of the boiler room and force it through the air preheater and through two large ducts per boiler down the front of the boiler room to the burners. These fans have a capacity of 55,000 cu.ft. per minute at 100 deg. F. They are driven by 440-volt, 125-hp., alternating-current slip-ring motors with a maximum speed of 1,150 r.p.m. and a speed variation of 50 per cent. The induced draft fans take the gases from the air preheater and discharge them into a breeching leading to a single concrete stack. These fans each have a capacity of 100,000 cu.ft. per minute at 380 deg. F., and are driven by 440-volt, 250-hp., alternating-current slip-ring motors with a maximum speed of 585 r.p.m., and a speed range of 50 per cent. Additional draft control is obtained by means of electric-operated dampers in both the forced and induced draft ducts controlled by push and pull-buttons located on the boiler control panel.

Coal is received at the plant in hopper-bottom cars on either of two tracks, each of which is fitted with a track hopper. One track is between the coal storage pile and the boiler room and the other is located on the other side of the storage pile. The outside track hopper is connected to the discharge of the nearest hopper by means of an underground belt conveyor. From the track hoppers coal is fed to a 50-ton capacity rigid hammer type crusher and then to a bucket elevator, by means of which it is elevated to the top of the boiler room and discharged to a distributor belt, which distributes it to the three bunkers. At the receiving end of the distribution belt the coal passes over a Merrick weightometer for automatic weighing. Bailey coal meters are also installed in the coal spouts to the pulverizers in order to weigh the coal to the individual pulverizer units. An overhead bridge-type crane, equipped with a 2-yd. bucket, spans a coal unloading trestle, the storage pile and one of the track hoppers, thus providing facilities for handling coal from the cars to storage and reclaiming from storage to the track hopper.

Motor-operated ash gates, located at the bottom of the furnace hopper below the water screen, drop the ash into a sluiceway through which part of the condenser circulating water is passed. The sluiceway discharges into a pit, from which the water and ash are picked up by two 8-in. dredge pumps and discharged on adjoining low ground. Here the ash settles out and the water slowly drains back into the river.

The various station power auxiliaries are arranged in

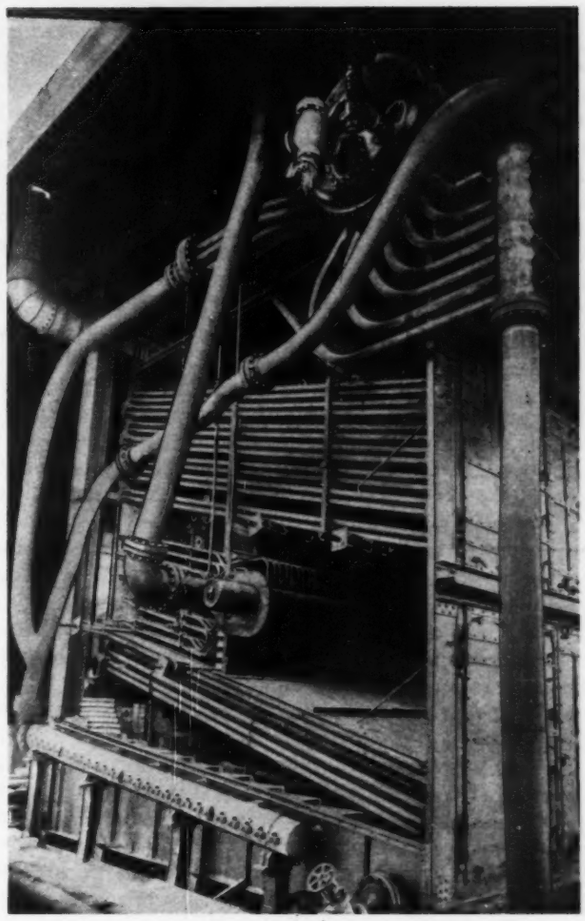


One-line diagram of station power buses, showing types of control

six groups, each connected to the main station power bus through an oil-circuit breaker as shown on the drawing. This arrangement is expected to reduce interruptions to the station power by permitting only the oi -circuit breaker controlling the group at fault to trip. The station power bus is supplied with power at 480 volts by two banks of transformers. One bank consists of three 750-kva. single-phase transformers and connects directly to the station ring bus through an automatic oil-circuit breaker. The other bank consists of one 200-kva. three-phase transformer and is connected to the rotary connecter transformer group bus, as shown in the diagram. The three-phase transformer is installed for stand-by and plant shutdown service.

The diagram of the station power layout shows the methods used to connect the various motors to the group buses. These are four different types of contactors used for motor starting, a contactor with an alternating-current closing coil which must be reclosed by hand in case the alternating-current power fails, a contactor with an alternating-current closing coil which will reclose the contactor upon the return of power after a failure, a contactor with a direct-current closing coil which will hold the contactor closed so long as there is a direct-current power, and a manually operated contactor. All motors are started across the line. The control for the oil-circuit breakers to the group buses, the oil-circuit breakers on the two circulating pump motors and other miscellaneous auxiliaries having electrically controlled contactors is centered on a station power switchboard, which is conveniently located in the generator room at the end of, and at right angles to, the main switchboard. On this board are also located the relays for the automatic oil-circuit breakers.

Two 10-kw. motor-generator sets, one of which is a reserve, each connecting to a different station power group bus, furnish direct-current power for the operation of the magnetic separators, the dampers and the pulverizer feeder motors. The control for these two motor-generator sets is so arranged that should the group bus to which the set being used is connected become de-energized, the other set will immediately start up, providing the group bus to which it is connected is energized.



BOILER, SUPERHEATER AND WATER-WALL CIRCULATING PIPING BEFORE BRICKING-IN

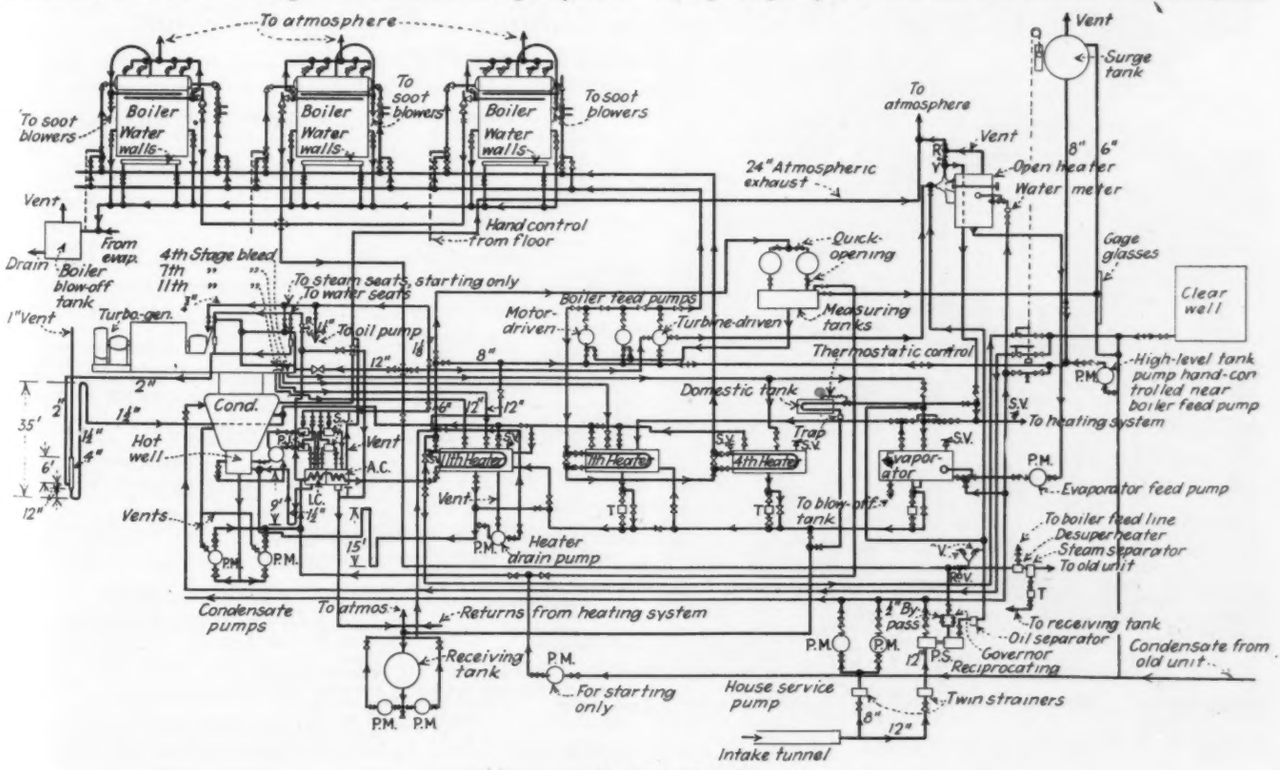


Diagram of Main Station Layout

The motors on the drum controllers for the forced and induced draft fans are operated from the station storage battery. It is necessary to operate these drum controller motors from the storage battery because in case the station power fails the drum controllers must return to starting position, all resistance in, before the fan motors can be started.

The generating rating is 25,000 kva., 5,000 volts, 2,890 amp., three phase, 60 cycle. The generator is excited by a 135-kw., 250-volt, direct-connected exciter, which, in turn, is excited by a 2-kw., 115-volt pilot exciter mounted on the frame of the main exciter. The two exciters insure stable operation under conditions that make it necessary to carry a weak field on the generator. The grounding system layout, including all motors in the plant, is very complete. At present the generator neutral is not grounded. Ground plates connected by pigtails to the ground network were located in each motor base when it was poured. Each motor frame is grounded with a copper cable to the ground plate. The generator is protected at all times against a fault in the windings by differential relays which trip both the generator oil-circuit breaker and the field switch. These are located on a separate panel apart from the main switchboard. The generator is protected against overload only during synchronizing. The tripping circuit from the overload relays is through a contact on the synchronizing switch.

The main station bus is built in ring form with disconnects between the points where the various circuits tap on. At present there is only one bus tie oil-circuit breaker, but ultimate plans call for two. There is a set of disconnects located where the future bus tie breaker will be installed, and this set is usually open, thus permitting the ring bus to be split by the other breaker.

From the sketch of the ring bus it may be seen that with the disconnects open between the frequency changer and the rotary converter transformer group, the bus tie oil-circuit breaker can be opened during cases of transmission line trouble, leaving the 20,000-kw. turbine on the half of the bus with the local distribution. The 140-kv. transmission line and frequency changer would then be left on the other half. A transfer regulator connecting to the main ring bus, a transfer bus and transfer oil-circuit breakers on each distribution circuit provides a means of transferring any distribution circuit to the transfer regulator. A 44-kv. transmission line connects to the distribution group bus instead of to the main ring bus. This allows for carrying this group bus off this transmission line while the group oil-circuit breaker is being removed for inspection or repair. The station lights may be supplied from either of two banks of 37-kva. transformers, which are connected to the station power bus or from the steam-driven exciter, which is an auxiliary for the 3,000-kw. generator.

As previously stated, the plant was started on June 1, and although some starting troubles were experienced, these troubles were not serious, and after a few days' time the plant was put into regular full-load operation and has operated according to system demands since that time. Although the boiler efficiencies are not yet all that was expected, due to some adjustments that are necessary in connection with the fuel-burning equipment, these troubles are not serious nor anything that should be difficult to overcome. The plant efficiency is much better than has been the experience of this company with a plant so soon after it was started. At the time of the design of the plant it was contemplated it would be possible to generate 1 kw.-hr. with 1¼ lb. of good quality coal, and the present results show that it will be easily possible to reach this figure. These are not the highest efficiencies as considered today, but for a plant of this size are very satisfactory results for the pressures and conditions that were adopted in the design. This plant was designed by the engineering department of the Commonwealth Power Corporation and built by the construction department of the Consumers Power Company.

Data on Principal Equipment in Addition to Kalamazoo Station Consumers Power Company

Turbo-Generator

Manufacturer	General Electric Co.
Number	1
Rated capacity, kw.	20,000
Rated capacity, kva.	25,000
Voltage	5,000
Phase	3
Frequency	60
Revolutions per minute	1,800
Steam pressure, gage	375
Superheat, deg. F.	250

Direct-Connected Exciters

Main exciter	
Rated capacity, kw.	135
Voltage	250
Amperes	540
Pilot exciter	
Rated capacity, kw.	2
Voltage	125
Amperes	16

Generator Air Coolers

Manufacturer	General Electric Co.
Cooling surface, sq.ft.	11,700
Number of passes	4
Kind of tubes	Admiralty
Diameter of tubes	1 in.
Cooling water supply	Raw water

Condensers

Manufacturer	Wheeler Cond. & Eng. Co.
Tube surface, sq.ft.	25,000
Connection to turbine	Rigid
Support	Springs
Kind of tubes	Admiralty
Diameter of tubes	1 in.
Water passes	2

Circulating Pumps

Manufacturer	Wheeler Cond. & Eng. Co.
Number	2
Speed, r.p.m.	400
Capacity, g.p.m. (1 pump)	15,500
Drive	440-volt, 125-hp. a.-c. motor

Condensate Pumps

Manufacturer	Wheeler Cond. & Eng. Co.
Number	2
Type	2-stage centrifugal
Speed, r.p.m.	1,150
Capacity, g.p.m. (1 pump)	600
Drive	440-volt, 40-hp. a.-c. motor

Air Ejectors

Manufacturer	Wheeler Cond. & Eng. Co.
Number	1
Type	Twin 2-stage jets with inter- and after-condenser
Capacity	.25 cu.ft. free air at 28.5 in. vac.
Steam consumption (2 jets)	1,280 lb. per hour

Boiler-Feed Pumps

Manufacturer	Pennsylvania Pump & Compressor Co.
Type	Centrifugal 2 six-stage, 1 four-stage
Discharge head	1,185 ft.
Suction head	+ 35 ft.
Capacity (1 pump)	600 g.p.m.
Drive	2 440-volt, 300-hp. a.-c. motors, 1 300-hp. Kerr. tur.

Feed-Water Heaters

Manufacturer	Griscom Russell Co.
Number	3
Surface	
11th stage	1,170 sq.ft.
7th stage	1,080 sq.ft.
4th stage	1,016 sq.ft.

Evaporator

Manufacturer	Griscom Russell Co.
Number	1 single effect
Location	Between 4th and 7th stages
Capacity	12,000 lb. per hr.

Boilers

Manufacturer	Springfield Boiler Co.
Type	Cross-drum
Number	3
Rated horsepower	1,536 hp.
Size of tubes	3 in., 9 gage
Steam pressure	400 lb. gage
Furnace volume	8,750 cu.ft.

Water-Cooled Walls

Manufacturer	Combustion Engineering Co.
Bottom Screen	
Type	Lopulco
Size of tubes	4 in., 6 gage
Heating surface	320 sq.ft.
Side walls (2)	
Type	Fin
Size of tubes	4 in., 6 gage
Heating surface	900 sq.ft.

Rear wall
Type ..... Fin
Size of tubes ..... 4 in., 6 gage
Heating surface ..... 550 sq.ft.
Total water-cooled surface ..... 1,770 sq.ft.

Superheater

Manufacturer ..... Superheater Co.
Type ..... Elesco 4 loop
Location. Interdeck-Headers through setting

Air Preheaters

Manufacturer .. Combustion Engineering Co.
Number 3
Type ..... Vertical plate, counter flow
Spacing (air passages) ..... ½ in.
Spacing (gas passages) ..... ½ in.
Height of elements ..... 16 ft.
Width of element ..... 5 ft.
Number of elements 150
Heating surface ..... 21,600 sq.ft.

Induced Draft Fans

Manufacturer ..... Clarage Fan Co.
Number 3
Capacity .... 100,000 c.f.m. at 380 deg. F. and 8.5-in. draft
Maximum speed ..... 585 r.p.m.
Drive ..... 250-hp., a.-c. slip-ring motor
Speed variation ..... 50 per cent

Forced Draft Fans

Manufacturer ..... Clarage Fan Co.
Number 3
Capacity ..... 55,000 c.f.m. at 100 deg. and 8.25-in. pressure
Drive ..... 125-hp. a.-c. slip-ring motor
Maximum speed ..... 1,150 r.p.m.
Speed variation ..... 50 per cent

Stacks

Number 1
Kind ..... Concrete
Height ..... 267 ft.
Diameter inside at top ..... 12 ft.

Unit Pulverizers

Manufacturer .... Furnace Engineering Co.
Number 6
Size ..... 5-A Simplex
Capacity ..... 8,000 lb. per hour
Drive ..... 100-hp. a.-c. induction motor
Kind of fuel ..... West Virginia bituminous
Heat value per pound as fired .. 13,200 B.t.u.

Burners

Manufacturer ..... Furnace Engineering Co.
Type ..... Bailey-Tenney
Number 12
Capacity each burner .... 4,000 lb. per hour

Coal-Handling Equipment

Manufacturer ... Jeffrey Manufacturing Co.
Type of conveyors .... Belt conveyors and bucket elevator
Crusher ..... Rigid hammer type
Capacity ..... 50 tons per hour
Coal scales ..... Merrick Weightometer
Coal meters ..... Bailey Meter Co.

Miscellaneous Equipment

Building steel .. Wisconsin Bridge & Iron Co.
Steel sash and skylights .. Truscon Steel Co.
Firebrick .....
Firebrick ..... Harbison-Walker Co. / A. P. Green Co. / Chas. Taylor Sons Co.
Insulating brick ..... Celite Products Co.
Front boiler walls ..... Liptak Fire Brick Arch Co.
Station crane ..... Cleveland Crane & Engineering Co.
Elevators ..... Hollister-Whitney Co.
Traveling screens ..... Chain-Belt Co.
Soot blowers ..... Bayer Co.
Sump pumps .... American Steam Pump Co.
Service pumps .. American Steam Pump Co.
Heater drip pumps ... Worthington Pump & Machinery Corp.
Oil-purification system ... DeLaval Steam Turbine Co.
Air compressor .... Pennsylvania Pump & Compressor Co.
Feed-water regulator .. Northern Equip. Co.
Constant excess pressure regulator, S-C Regulator Mfg. Co.
Evaporator feed-water heater, Swartwout Co.
High-pressure gate valves, Lunkenheimer Co.
Piping ..... Murray W. Sales & Co.
Recording instruments .. Bailey Meter Co.
Indicating thermometers, Taylor Instrument Co. —Brown Instrument Co.
Boiler meters ..... Bailey Meter Co.
Venturi meters ..... Builders Iron Foundry
Draft gages ..... L. M. Ellison Company

Pole-Setting Costs Cut 37 Per Cent

A LINE construction truck equipped with an earth auger saved a Middle Western utility $4,187 in ten months of operation and increased the speed of pole setting and the efficiency of the unit. The boring heads are universal in movement and adjustable to 45 deg. in any direction by means of a worm sector on each head. The latter also provides a means of rigidly locking the heads in any desired position. This universal movement means that the auger rack can be brought to a perpendicular digging position quickly.

According to the Four Wheel Drive Auto Company, this device will bore any hole and set the pole in any location where hand digging is possible and where it is practicable to place a truck. Cost data were as follows:

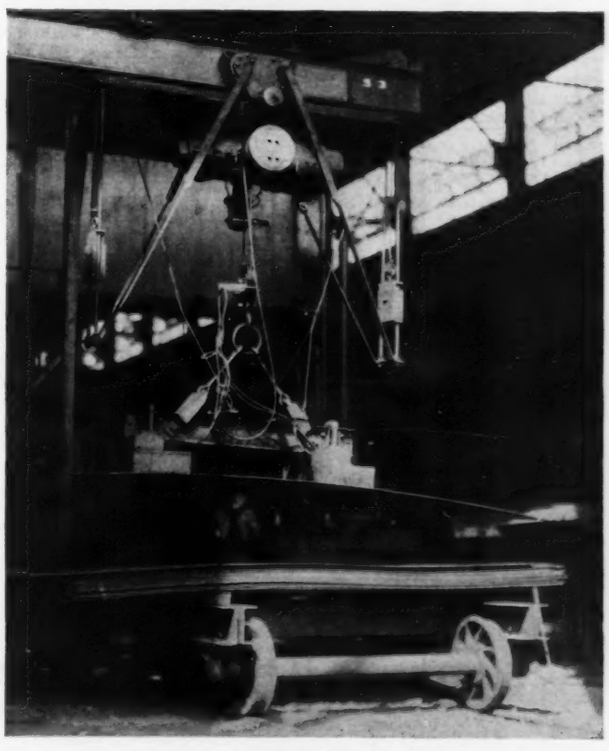
Truck traveled, miles	1,600	Interest and depreciation per pole	$0.83
Holes dug	2,931	Repairs per pole	$0.137
Poles set	3,102	Total cost per pole	$2.287
Poles replaced	749	Cost by hand method	$3.63
Labor cost per pole	$0.89	Saving by machine	$1.35
License and truck expense, per pole	$0.43	Saving on 3,102 poles	$4,187.70

The actual saving, however, was greater than this, as the machine was used considerably for maintenance work and the operating cost for this service is included in the totals. Twenty per cent of the poles set were replacements. The saving effected through the pulling of the old poles is not included in the $4,187.70.

Crane Magnets Aid Metal Handling

PRESSED steel car ends and similar material in the form of steel plates are now handled by the Union Metal Products Company, of Hammond, Ind., in a manner that offers greater ease, speed and economy and has marked safety features.

Two rectangular lifting magnets, manufactured by the Electric Controller & Manufacturing Company, of Cleveland, are hung from a spreader beam, which in turn is suspended by a cable from a monorail hoist. The plates are charged into a heating furnace, one at a time, by an operator located in a control room opposite the end of the furnace. The floor man, who is customarily used to steady the plates as they are carried to the charging platform, has been eliminated by the introduction of a mechanical device. Two arms extend from the monorail hoist parallel to the track, and vertical slides are hung and rigidly braced at each end. A counterweight is suspended at each end from a cable that runs up over a pulley and down at an angle to the spreader beam supporting the magnets. This rigging has been found to be sufficient to hold the magnets in proper alignment and to damp swinging after one or two oscillations.



MAGNETIC CRANE ELIMINATES FLOOR MAN

Forward and Reverse Operation Controlled by Single Button

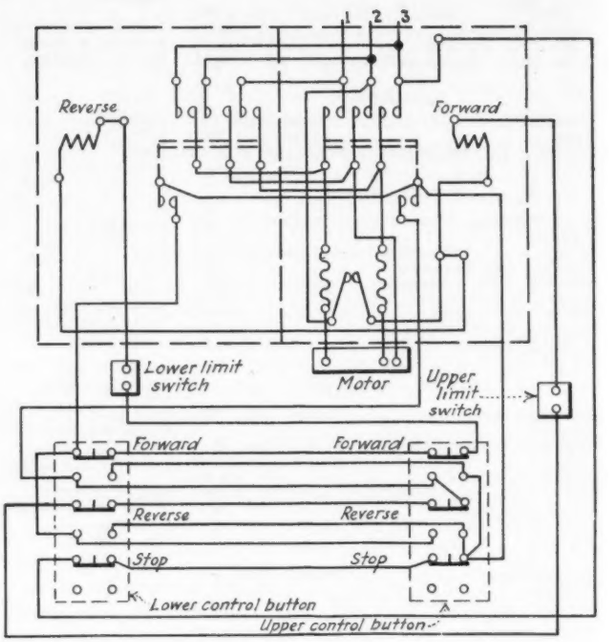
By H. W. Wikle
General Electric Company, Atlanta, Ga.

OPERATING practices in the plant of the Louisiana Pulp & Paper Company at Bastrop, La., required an unusual control plan for a chain conveyor driven through a worm gear by a 7½-hp. 440-volt, three-phase 60-cycle, squirrel-cage induction motor. This conveyor is 40 ft. long and rises to an elevation of approximately 9 ft. Control from the upper and lower terminals is desirable.

Referring to the starting point as "A" and the end as "B," it was desired (1) to start the conveyor in the forward or upward direction by means of a push button located at "A"; (2) stop the upward motion by a push button at "B"; (3) start the conveyor in the opposite or downward direction by the same push button at "B," and (4) stop the downward motion by the same push button at "A."

The accompanying diagram indicates how this result was accomplished through the use of a magnetic reversing switch, two limit switches and two push-button stations. One push button starts the motor forward and also stops the motor when it is running in the reverse direction. The other push button starts the motor in the reverse direction and also stops the motor when it is running forward.

The controls are so interlocked that with the motor running forward from one push button it must be stopped at the other one before the latter can be operative to reverse the direction of rotation of the motor. Likewise with the motor running in the reverse direction from the second push button it must be stopped at the first before starting the motor in the forward direction.



SCHEMATIC DIAGRAM OF TWO-BUTTON MULTIPLE ACTION CONTROL

Capacities of Meters and Ratings of Instrument Transformers

Standards of West Penn System

SIZE OF METER REQUIRED

Residences; wholesale houses; elevators ..... 35 to 50 per cent of connected load
Stores ..... 75 per cent of connected load
Small stores; restaurants; single motors ..... 100 per cent of connected load

CAPACITIES IN KVA. FOR FULL LOAD ON STANDARD METERS

Size	Single Phase			Three-Phase					Direct Current Two Wire
	Two-Wire		Three-Wire						
Amp.	115 Volts	230 Volts	115–230 Volts	230 Volts	460 Volts	2,300 Volts	6,900 Volts	25,000 Volts	650 Volts
5	0.6	1.2	.....	2.3	4.6	23	69	250	3.3
10	1.2	2.3	2.3	4.6	9.2	46	138	500	6.5
15	1.7	3.5	3.5	6.9	13.8	69	207	750	9.8
25	2.9	5.8	5.8	11.5	23.0	115	345	1,250	16.3
50	.....	11.5	11.5	23.0	46.0	230	690	2,500	32.5
Above Meters are Self-Contained									
75	.....	17.3	17.3	34.5	69.0	345	1,035	3,750	48.8
100	.....	.....	23.0	46.0	92.0	460	1,380	5,000	65.0
150	.....	.....	34.5	69.0	138.0	690	2,070	7,500	97.5
200	.....	.....	46.0	92.0	184.0	920	2,760	10,000	130.0
300	.....	.....	69.0	138.0	276.0	1,380	4,140	15,000	195.0
400	.....	.....	92.0	184.0	368.0	1,840	5,520	20,000	260.0
500	.....	.....	115.0	230.0	460.0	2,300	6,900	25,000	325.0
750	.....	.....	173.0	345.0	690.0	3,450	10,350	37,500	488.0
1,000	.....	.....	230.0	460.0	920.0	4,600	13,800	50,000	650.0
1,500	.....	.....	345.0	.....	1,380.0	6,900	20,700	75,000	975.0
2,000	.....	.....	460.0	.....	1,840.0	9,200	27,600	100,000	1,300.0
	Above meter needs one current transformer	Above meters need one three-wire or two two-wire current transformers	Above meters need two current transformers	Above meters need two potential and two current transformers		Use 6,900 volt metering equipment or two potential and two current transformers	Use high-tension metering equipment or two potential and two current transformers	Use shunts and external resistances as required for each make of meter	

SIZE OF CURRENT TRANSFORMERS, PRIMARY AMPERES

Indoor Two-Wire 4,600 Volt	Indoor Three-Wire 1,150 Volt	Indoor Two-Wire 6,900 Volt	Outdoor Two-Wire 6,900 Volt	Outdoor Two-Wire 13,800 Volt	Busbar Two-Wire 2,300 Volt	Indoor or Outdoor Oil Insulated Volt 34,500
5	.....	5	5	5	750	5–10
10	.....	10	10	10	1,000	10–20
15	.....	15	15	15	1,500	15–30
25	.....	25	25	25	2,000	25–50
50	.....	50	50	50	2,500	50–100
75	75	75	75	75	3,000	75–150
100	100	100	100	100	4,000	100–200
150	150	150	150	150	5,000	150–300
200	200	200	200	200	7,500	200–400
300	300	300	300	300	10,000	.....
400	400	400	400	400	.....	.....
500	500	500	500	500	.....	.....
750	.....	750	.....	.....	.....	.....
1,000	.....	1,000	.....	.....	.....	.....

NOTE: Transformers will stand 20 per cent overload continuously. All current transformers have a 5-amp. secondary rating.

RATED VOLTAGES OF POTENTIAL TRANSFORMERS

Primary Voltage	Voltage Ratio	Types
230	2:1	Dry type
460	4:1	Dry type
2,300	20:1	Dry type
6,900	60:1	Dry type; indoor oil-insulated type
13,800	120:1	Indoor oil-insulated type; outdoor oil-insulated type
23,000	200:1	Indoor oil-insulated type; outdoor oil-insulated type
66,000	600:1	Indoor oil-insulated type; outdoor oil-insulated type

Four-Wire Metering

Various methods available discussed with data showing comparative accuracies obtained. The three-phase, four-wire, three-element meter adopted by the Memphis Power & Light Company

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MEASUREMENT of energy in three-phase, four-wire circuits may be done in any of the following four ways: (*a*) With three single-phase meters, (*b*) a three-phase, four-wire, three-element meter, (*c*) a three-phase, four-wire, two-element, split-coil meter having a third current coil with an equal number of ampere turns working with each potential coil but 60 deg. out of phase and (*d*) a three-phase, three-wire, two-element meter using three current transformers with their secondaries connected in delta. Based on the experience of the Memphis Power & Light Company, the first two methods, *a* and *b*, are the most desirable, because of the accuracy of registration.

Three single-phase meters, as used in *a*, are the easiest to test and can be calibrated to a higher degree of accuracy, there being no interference between elements and the necessary bucking and balancing of the elements are eliminated. As regards first costs of the four methods, the following figures may be used for comparison based on an 100-amp., 2,200-volt to 110-volt installation, the figures including only the cost of the meter or meters as the case may be, current and potential transformers and test blocks: Method *a*, $170; *b*, $185; *c*, $145, and *d*, $140. Labor and other materials will change the ratio between the various methods to some extent for the entire installation.

As noted, the first cost of the three single-phase meter method is less than the three-element meter method, but the method taken as a whole is less satisfactory, as there are more chances for error occurring in the preparation of the bills where the three readings must necessarily be added. Also, if the customer has separate power and lighting contracts, some confusion and expense may arise as to which meter is the lighting meter. In addition, with three single-phase meters the measurement of demand, which is necessary in most cases, requires special equipment. For these reasons and others that will be discussed later in reference to methods *c* and *d*, the Memphis company adopted the three-element meter when the three-phase, four-wire network system was installed in Memphis. (See ELECTRICAL WORLD for Oct. 23, 1926, page 855, for a description of this system.)

From the standpoint of first cost, the three-element meter method is the most expensive, but, when all factors are considered, it is really the most satisfactory. Most of the objectionable features of the three single-phase methods are eliminated in this meter and all of the desirable features have been retained, except the ease of testing.

The results obtained from the use of three single-phase meters and from three-element meters, so far as accuracy of registration is concerned, are identical. As a typical example, assume a voltage from phases A, B and C to neutral of 100 volts and a balanced load of 5 amp. on each phase. From the power formula we have at unity power factor

$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_bI_b \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase B
$E_cI_c \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase C

or a total energy consumed and registered of 1,500 watts, the correct figure. If the voltage in phase A is increased to 110 volts, then

$E_aI_a \cos\theta = 110 \times 5 \times 1 = 550$ watts in phase A

ACCURACIES OF TWO-ELEMENT SPLIT-COIL METER (FIGS. 1 TO 6) AND OF TWO-ELEMENT METER USING THREE CURRENT TRANSFORMERS CONNECTED IN DELTA (FIGS. 7 TO 12)

Figure Number	Voltages A	Voltages B	Voltages C	Load, Watts A	Load, Watts B	Load, Watts C	Energy Consumed, Watts	Energy Registered, Watts	Accuracies of Registration, Per Cent
1 and 7...	100	100	100	500	500	500	1,500	1,500	100.00
2 and 8...	100	110	100	500	500	500	1,500	1,454	96.93
3 and 9...	110	100	110	500	500	500	1,500	1,550	103.33
4 and 10...	100	100	110	500	500	500	1,500	1,525	101.67
5 and 11...	100	100	100	400	700	400	1,500	1,500	100.00
6 and 12...	110	100	110	400	700	400	1,500	1,570	104.67

with phases B and C remaining as above, giving the total energy consumed and registered of 1,550 watts, which is correct. If the voltages in phases A and B are both 110 volts, then

$E_aI_a \cos\theta = 110 \times 5 \times 1 = 550$ watts in phase A
$E_bI_b \cos\theta = 110 \times 5 \times 1 = 550$ watts in phase B

with phase C remaining as above, giving the total energy consumed and registered of 1,600 watts, the correct figure. Thus the three single-phase meters or the three-element meter will register correctly at all times any unbalance of voltage or load that may occur.

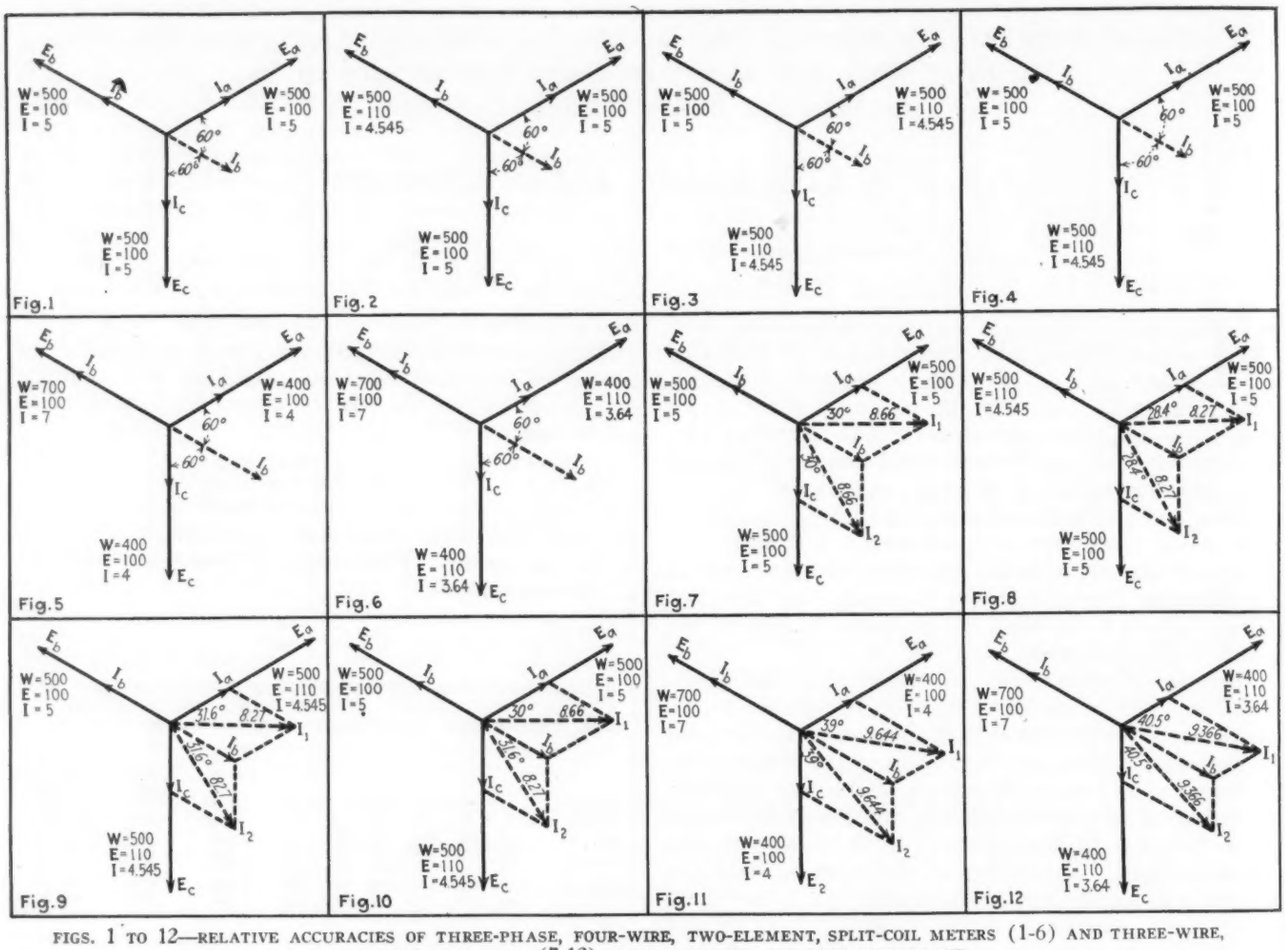
The three-phase, four-wire, two-element, split-coil meter will register correctly providing the voltages are balanced, but it is very hard to adjust properly because as yet the manufacturers have provided no way for making any adjustment on the split coil. Also, this meter requires the carrying of spare parts that are not interchangeable with other meters. The accuracies of this meter under various conditions of voltage and load unbalance are shown in Figs. 1 to 6, inclusive, all examples being taken with unity power factor.

The three-phase, four-wire, two-element meter with three current transformers costs less than the three-element meter, but, like the split-coil meter, is not accurate with unbalanced voltages.

A fact not generally realized is that the split-coil meter and the delta-connected meter give the same accuracies

under the same conditions of voltage unbalance. To illustrate this point the results obtained from the formulas used in conjunction with Figs. 1 to 12, inclusive, have been tabulated, this tabulation being given herewith.

The problems of metering three-phase, four-wire systems may be summed up as follows: The three single-phase meter is accurate, is easily calibrated and connections are easily made and checked, but it has the disadvantage of not recording total registration on one dial, requires more mounting space and is not suitable for



FIGS. 1 TO 12—RELATIVE ACCURACIES OF THREE-PHASE, FOUR-WIRE, TWO-ELEMENT, SPLIT-COIL METERS (1-6) AND THREE-WIRE, TWO-ELEMENT METERS (7-12) UNDER VOLTAGE AND LOAD UNBALANCE

Fig. 1—Voltages on phases A, B and C, 100 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 100 \times 5 \times 0.5 = 250$ watts plus
$E_cI_b \cos\theta = 100 \times 5 \times 0.5 = 250$ watts in phase B
$E_cI_c \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 2—Voltages on phases A and C, 100 volts; phase B, 110 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 100 \times 4.545 \times 0.5 = 227$ watts plus
$E_cI_b \cos\theta = 100 \times 4.545 \times 0.5 = 227$ watts in phase B
$E_cI_c \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,454 watts; meter 3.07 per cent slow.

Fig. 3—Voltages on phases A and C, 110 volts; phase B, 100 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 110 \times 4.545 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 110 \times 5 \times 0.5 = 275$ watts plus
$E_cI_b \cos\theta = 110 \times 5 \times 0.5 = 275$ watts in phase B
$E_cI_c \cos\theta = 110 \times 4.545 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,550 watts; meter 3.33 per cent fast.

Fig. 4—Voltages on phases A and B, 100 volts; phase C, 110 volts; balanced load of 500 watts on each phase.
$E_aI_a \cos\theta = 100 \times 5 \times 1 = 500$ watts in phase A
$E_aI_b \cos\theta = 100 \times 5 \times 0.5 = 250$ watts plus
$E_cI_b \cos\theta = 110 \times 5 \times 0.5 = 275$ watts in phase B
$E_cI_c \cos\theta = 110 \times 4.545 \times 1 = 500$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,525 watts; meter 1.67 per cent fast.

Fig. 5—Voltages on phases A, B and C, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_a \cos\theta = 100 \times 4 \times 1 = 400$ watts in phase A
$E_aI_b \cos\theta = 100 \times 7 \times 0.5 = 350$ watts plus
$E_cI_b \cos\theta = 100 \times 7 \times 0.5 = 350$ watts in phase B
$E_cI_c \cos\theta = 100 \times 4 \times 1 = 400$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 6—Voltages on phases A and C, 110 volts; phase B, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_a \cos\theta = 110 \times 3.64 \times 1 = 400$ watts in phase A
$E_aI_b \cos\theta = 110 \times 7 \times 0.5 = 385$ watts plus
$E_cI_b \cos\theta = 110 \times 7 \times 0.5 = 385$ watts in phase B
$E_cI_c \cos\theta = 110 \times 3.64 \times 1 = 400$ watts in phase C
Energy consumed, 1,500 watts; energy registered, 1,570 watts; meter 4.67 per cent fast.

Fig. 7—Voltages on phases A, B and C, 100 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 100 \times 8.66 \times 0.866 = 750$ watts on element 1
$E_cI_2 \cos\theta = 100 \times 8.66 \times 0.866 = 750$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 8—Voltages on phases A and C, 100 volts; phase B, 110 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 100 \times 8.27 \times 0.8794 = 727$ watts on element 1
$E_cI_2 \cos\theta = 100 \times 8.27 \times 0.8794 = 727$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,454 watts; meter 3.07 per cent slow.

Fig. 9—Voltages on phases A and C, 110 volts; phase B, 100 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 110 \times 8.27 \times 0.852 = 775$ watts on element 1
$E_cI_2 \cos\theta = 110 \times 8.27 \times 0.852 = 775$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,550 watts; meter 3.33 per cent fast.

Fig. 10—Voltages on phases A and B, 100 volts; phase C, 110 volts; balanced load of 500 watts on each phase.
$E_aI_1 \cos\theta = 100 \times 8.66 \times 0.866 = 750$ watts on element 1
$E_cI_2 \cos\theta = 110 \times 8.27 \times 0.852 = 775$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,525 watts; meter 1.67 per cent fast.

Fig. 11—Voltages on phases A, B and C, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_1 \cos\theta = 100 \times 9.644 \times 0.777 = 750$ watts on element 1
$E_cI_2 \cos\theta = 100 \times 9.644 \times 0.777 = 750$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,500 watts; meter correct.

Fig. 12—Voltages on phases A and C, 110 volts; phase B, 100 volts; 400 watts on phases A and C, 700 watts on phase B.
$E_aI_1 \cos\theta = 110 \times 9.366 \times 0.7604 = 785$ watts on element 1
$E_cI_2 \cos\theta = 110 \times 9.366 \times 0.7604 = 785$ watts on element 2
Energy consumed, 1,500 watts; energy registered, 1,570 watts; meter 4.67 per cent fast.

recording maximum demand. The split-coil meter and the two-element meter with three current transformers the secondaries of which are connected in delta are inaccurate on unbalanced voltage and connections are not easily made or checked. The delta connection requires oversize transformers or 10-amp. meter coils, and the split-coil meter is hard to calibrate and parts are not interchangeable. The three-element meter is accurate under all conditions of load and voltage, is suitable for demand recording and the total registration is recorded on one dial. The connections are also easily made. The disadvantages of higher first cost and possibly of the fact that the moving element is heavier, causing greater wear on the jewel, are offset by the fact that the method is accurate under all conditions which have been studied in this investigation.

Power Requirements of Machinery Used in Cotton Mills

Trends in motor drive practice. Average data on typical applications. Plant load distribution analysis offered in connection with estimate basis

By H. H. BODGE

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SINCE 1894, when the pioneer textile electric drive was installed in the shape of seventeen 65-hp. induction motors at the Columbia Mills, in Columbia, S. C., the growth of electric service in textile mills has increased to a point where more than two-thirds of the 3,000,000 hp. required to run these establishments in this country is furnished by motors. In outlining the trends in motor application it may be helpful to touch briefly upon the present process routine involved in cotton mills.

Purchased cotton arrives in 450- to 600-lb. bales measuring about 30x40x58 in. The first process requiring power is the opener. Cotton is fed from the bale or from the mixing floor to the feed box, where it passes through a beating process, which loosens the compressed fibers and beats out some of the motes and dust. After beating it passes by suction through a pipe or conductor to the next machine. Openers are best operated by individual drive, the motor mounted on the machine and belted directly to the drive pulley. The average type of opener requires 3 hp. preferably ventilated by ducts directly from outside air.

The next process, lapping, further cleans and loosens the fibers and forms them into laps or rolls. Usually there are three lapping machines—the breaker, the intermediate and the finisher. All three continue to clean the cotton. During the last few years single machines have been introduced that accomplish the required beating in one operation or handling and in general effect a combination of the three processes previously used. Such an outfit requires 20 hp. to operate. All types of lappers are best driven with individual motors. The elimination of overhead belting and shafting in the picker room is very desirable, owing to the large amount of lint and dust that collects everywhere. The fire hazard is large and warrants extra precautions and expense to avoid the possibility of fire from overheated motors or improper wiring.

The laps are carried next to the cards, where the cotton is fed over a revolving cylinder covered with what is known as card clothing. This clothing is made of cloth or rubber having wire teeth of about No. 34 gage inserted in it which stand 200 to 600 per square inch. Through this the cotton is passed. The combing action of the process further cleans and lays the fibers more or less parallel to one another. From this cylinder the combed cotton is removed in the form of a sheet, drawn through a trumpet and formed into a round mass called sliver. This is coiled in a can for handling.

A card is a delicately adjusted machine and great care must be taken not to overload it. The average production is about 150 to 175 lb. per day, or approximately one lap every two hours. Sliver cans hold from 7 to 8 lb. each and run full in about twenty minutes. Cards require very little power, the custom being to drive them in groups of twenty to twenty-five. When laying out a card room, 1 hp. per card is found to be about right. Some of the more recent installations in the South have used individual drive, the motor being geared directly to the drive shaft. This method is ideal but expensive.

Cotton is valued by its length of staple. Commercially graded cotton known as $1\frac{1}{4}$ staple will have mixed in it all lengths of fiber from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. The next process, combing, sorts out and rejects all (or any desired per centage of) fiber below $1\frac{1}{4}$ or below any other specified length. This treatment conduces to much evener and smoother yarn. Of late years combers have been introduced to handle much shorter fibers than previously and are coming more and more into use.

Before cotton is passed through the comber, however, two preparatory processes form the card sliver into narrow laps or cheeses from 8 to 14 in. in width. The first is called a sliver lap machine, which takes the card sliver from twelve to twenty cans and spreads them out into the shape of a lap. The second is called a ribbon lapper. Usually six sliver laps are fed into this machine, where it is drawn out to the weight of a single sliver lap. The lap delivered by this process is much evener and smoother than that delivered by the sliver lapper.

From the ribbon lapper this lap is fed to the comber, which sorts out and rejects the short fibers. The comber delivers its product in the form of a sliver similar to the card sliver. Combers require $\frac{1}{2}$ to $\frac{3}{4}$ hp., depending

*From a paper before the New England Association of Central Station Power Engineers.

upon whether they are six or eight head machines, and are driven in groups. The silver lapper requires 1 hp. and the ribbon lapper ½ hp. They are usually driven in the same group with the combers.

When the sliver leaves the comber, the fibers have been laid approximately parallel and are of uniform length, but owing to their natural tendency to curl and twist, they stand out in many directions. It is the purpose of the next process, drawing, to stretch some of this curl out of the fibers and to finish the process of parallelizing. Six cans of comber silver are fed together between rolls and drawn into one sliver. This constitutes one delivery of drawing. Each machine usually has six deliveries and requires 1 hp. to drive. Group drive is generally used for this process.

The several operations up to this point have been devoted to cleaning and parallelizing the fibers. In the next process, slubbing, twist is introduced and the product is wound on bobbins.

From the slubber these bobbins are passed to the roving frames, where the stock is further drawn out and twisted. There are generally three processes: slubbing, intermediate roving and fine roving. The work done in all of these processes is exactly the same. Each successive machine delivers finer (or lighter) stock than it receives. Four-frame drive is highly recommended for this process. In slubbing, 45 to 60 spindles operate on 1 hp. in intermediate roving, 55 to 65 spindles per horsepower and in fine roving from 80 to 100 spindles per horsepower. The variation is due to the various spindle speeds used. The faster the spindle speed the fewer the spindles that can be operated with 1 hp.

The final process in making yarn is spinning, which consists of further drawing out and imparting the final twist to the product. There are two ways in which spinning is accomplished—mule spinning and ring spinning. Mule spinning is the older system and is used almost universally in England. In the United States, however, ring spinning has supplanted the old method except for very fine yarns.

Several methods are in use for driving spinning frames—individual drive, four-frame drive and group drive. Individual drive, well installed, is without question the best that can be obtained, but it is expensive. Four-frame drive is very popular and is easily installed, 20-hp. double-end motors designed for the purpose being available. This makes a neat and flexible installation and has proved satisfactory in every way. Group drive is the least desirable, although the low investment cost makes it attractive when ample funds are not available. Groups requiring 100 hp. are installed in many mills, and although they are somewhat better than the steam drive, they tend to defeat the real advantages of motor drive. Groups requiring not more than 50 hp. give good results but lack the flexibility of the four-frame method.

The power required per spindle to operate spinning frames varies widely, depending on the speed of the spindle, the size of the yarn and whether the yarn spun is intended for warp or filling. The accompanying table gives the power required under various conditions. Sixty spindles per horsepower is a safe average.

Two kinds of yarn are spun in a cotton mill—warp yarn and filling yarn. The filling yarn passes directly from the spinning frames to the weave room. The warp yarn, however, requires the following processes: spooling, warping, slashing or sizing and drawing-in.

The object of spooling is to take yarn from bobbins, on which it has been spun and wound with irregular tension, and rewind it regularly on spools. These spools hold from ten to fifteen bobbins. Spoolers usually have about 250 spindles and are group driven. Each 250 spindles require 1 hp.

Warpers and spoolers are usually in the same room and all are driven by one motor. This is not objectionable when the total load does not exceed 35 to 40 hp. The full spools are next mounted on a reel, or frames holding from 300 to 600 spools, which are unwound and the strands laid evenly on a beam or large spool holding 24,000 yd. and weighing approximately 430 lb. The number of ends wound on the beam is determined by the character and width of the cloth to be woven. Warpers require about 1 hp. each and are group driven.

Slashing, or sizing, is the next process. Warper beams are unwound and the yarn is passed through a hot size

HORSEPOWER REQUIREMENTS OF COTTON MACHINERY

	Hp
Opener with feeder	2½
Hopper bale opener	3
Cylinder opener	6
Hopper feeder	1½
Self-feeding opener	3
1 Beater, breaker, lapper	5½
1 Beater, breaker, lapper, cage section	6
1 Beater, breaker, lapper, gauge, box and condenser	7½
Combined self-feeding opener and single beater breaker lapper	9
1 Beater, intermediate, lapper	4
1 Beater, finishing, lapper	4
2 Beaters, breakers, lappers	7½
2 Beaters, intermediates, lappers	6
2 Beaters, intermediates, lappers	7½
2 Beaters, finishing lappers	7½
2 Beaters, finishing lappers	9
6 Beaters, breakers, lappers	9
3 Beaters, intermediates, lappers	8½
3 Beaters, finishing lappers	8
Thread extricator and condenser	1½
Thread Extricator	1½
English card	1
American card	¾
Revolving flat card, 450 lb. per week	¾
Revolving flat card, 700 lb. per week	1
Revolving flat card, 1,000 lb. per week	1¼
Sliver lap machine	¾
Ribbon lap machine	½
No. 6 fan	¾
Railway head detached	¾
Comber, 6 head	¾
Comber, 8 head	¾
Drawing frames, ordinary rolls six deliveries per frame	1
Drawing frames, metallic rolls, five deliveries per frame	1
Slubber, 45 to 60 spindles per machine	1
Intermediate, 55 to 65 spindles per machine	1
Roving, 65 to 85 spindles per machine	1
Jack or fine roving, 100 spindles	1
Spoolers, 150 to 250 spindles per machine	1
Spoolers, 300 spindles per machine	1
Warpers, four to five per machine	1
Ball warper, two per machine	1
Slasher	1½
Spinning, *warp yarns*:	
16's and coarser, 70 spindles per machine	1
22's and coarser, 75 spindles per machine	1
40's and coarser, 80 spindles per machine	1
60's and coarser, 90 spindles per machine	1
80's and coarser, 100 spindles per machine	1
Spinning, filling-yarns:	
16's and coarser, 110 spindles per machine	1
22's and coarser, 90 spindles per machine	1
28's and coarser, 85 spindles per machine	1
40's and coarser, 90 spindles per machine	1
70's and coarser, 100 spindles per machine	1
90's and coarser, 110 spindles per machine	1
90's and coarser, 110 spindles per machine	1

Ring Spinning

Speed	Spindles per Horsepower: Yarn 7-10	Yarn 12-15	Yarn 20-30
5,000	140	150	170
5,500	125	140	150
6,000	110	125	140
6,500	100	110	125
7,000	90	100	110
7,500	80	90	100
8,000	70	80	90
8,500	63	70	80
9,000	54	63	70
9,500	49	54	63

Looms, 30 to 40 in., 5 per machine	1
Looms, 48 to 72 in., 4 per machine	1
Looms, 81 to 90 in., 3 per machine	1
Looms, 99 to 108 in., 2 per machine	1
Gingham loom, 5½ per machine	1
Wide loom (92 in.), 1 per machine	1

bath made principally of starch, after which it is run over a steam-heated drum and dried. It is then wound again on a beam and is ready for weaving.

Warp beams are placed on a frame with the loom harness suspended in front. There are two or more harnesses according to the character of the cloth woven. If two harnesses are used, one end of the warp is drawn through an eye in one harness and the next end through an adjacent eye in the other harness. With more harnesses, the warp may be drawn in various ways according to the design of cloth. Three to four looms operate with 1 hp. and are driven in groups requiring not more than 50 hp. each.

There is a growing tendency toward individual drive weaving, and this is unquestionably superior from a manufacturing standpoint. The investment, however, is high and I question whether the slight increase in production offsets the high fixed charges of such an installation.*

Since the World War the textile industry, especially in New England, has found itself confronted with keen Southern competition. High taxes, labor costs, obsolete machinery and worn-out power plants are largely responsible for the present Northern textile depression.

Many steam-driven mills would gladly turn to purchased power if finances allowed, realizing the advantages and low power costs derived from such a move. Under present conditions, however, ideal installations are difficult. Mill superintendents and treasurers are today carefully analyzing costs which a few years ago were considered trivial and are figuring in mills instead of cents as previously.

Old plants seldom electrify as a whole but install a motor here or there as required until it is found no longer profitable to continue running the engine. The general practice has been to split up the existing line shafts into groups and install the proper sized motor. This method is cheapest, and although far from perfect, is a vast improvement over the old drive.

The average cotton mill driven electrically has a load distribution as follows: Openers, waste machines and pickers, 4 per cent; carding, 6 per cent; drawing, combers and speeders, 22 per cent; spinning, 33 per cent; spooling and warping, 5 per cent; slashing, 1 per cent; weaving, 15 per cent; machine shop, 0.5 per cent; lighting load, 4 per cent; miscellaneous power, fire pump, elevators, etc., 9.5 per cent.

An over-all estimate of the horsepower required to operate a mill can be safely based upon 0.032 hp. per spindle—that is to say, a mill of 100,000 spindles would require 3,200 hp. plus about 20 per cent for being overmotored, or about 3,800 hp. in motors installed.

**The use of individual motor drives for looms is making striking headway, ½ hp. per loom being widely applied up to 42-in. and ¾ hp. on larger units, rising to 5 to 10 hp. on duck looms.*—EDITORS.

Load Distribution Between Parallel Lines

BY EARL BAUGHN
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FREQUENTLY it is desirable to know the distribution of power between two or more proposed dissimilar transmission lines in parallel under varying conditions of load or the effect of adding another line to an existing network. When calculated analytically, the equations become quite cumbersome and involved if more than two parallel lines are assumed. A simple graphical method based on the Perrine-Baum line regulation diagram has been used by the writer to solve both simple parallel lines and also quite complicated networks. Results for different assumed load conditions are quickly and easily determined.

The line regulation diagram as first proposed by Perrine and Baum, either in its simple form based on the resistance, reactance and capacitance of the line or the more accurate diagram based on the A, B, and C auxiliary constants of the line, is used by the author. However, any similar regulation diagram in which the receiving-end voltage is the vector of reference and the sending-end voltage vector is allowed to vary in phase displacement and amount may be used.

PARALLEL TRANSMISSION LINES

When two or more transmission lines are operated in parallel, there are three things common to all—namely, the sending-end voltage, the receiving-end voltage and the angular displacement between the sending-end and receiving-end voltages. Reference to Fig. 1 shows that the voltage regulation diagram gives the delivered kilowatts and power factor of a line for any sending-end voltage and angular displacement for an assumed constant receiver voltage. Therefore, to solve for the kilowatts transmitted and the power factor of parallel lines, it is necessary only to make line regulation diagrams for each line for the same receiver voltage, and by assuming the same sending-end voltage and angular displacement between sending and receiver voltages for the different lines, the division of power is immediately determined.

In order that results may be had much more accurately and quickly, the charts for the lines concerned are made on tracing cloth with the same volts per inch scale so that they may be placed one upon the other with the receiver voltages in coincidence. Then for any chosen point on a sending end voltage circle the power and power factor on each line may be read from the charts. Also since we are concerned only with the kilowatt part of the dia-

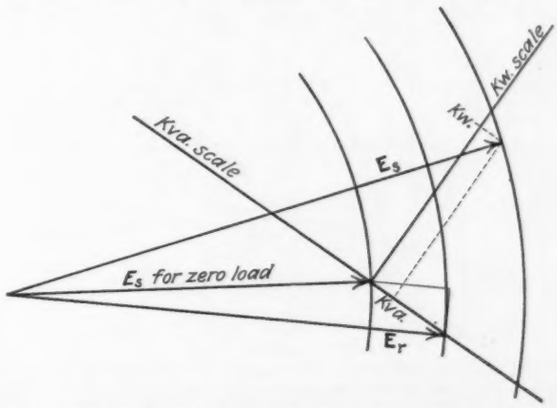


FIG. 1—LINE-REGULATION DIAGRAM (PERRINE-BAUM). Diagram gives delivered kilowatts and power factor of a line for any sending-end voltage and angular displacement for an assumed constant receiver voltage.

gram, the chart is usually constructed as shown in Fig. 2, the receiver voltage vector being represented only by its tip end and the chart turned in such a way that the kilowatt scale is vertical.

If one line is of different voltage than the other and has transformers at each end, the chart for that line must include the constants of the transformers added to those of the line. The constants of the line must also be reduced to the constants of an equivalent line referred to the voltage of the receiving bus.

The general method described may be extended to the solution of extended and complicated networks. For instance, assume the network represented in Fig. 3. To

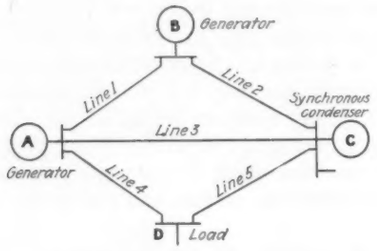


FIG. 3—TRANSMISSION NETWORK ASSUMED TO SHOW APPLICATION OF GRAPHICAL SOLUTION

Charts similar to those of Fig. 2 are made for each of the five lines and the same method of solution followed.

solve this network charts should be made to the same volts per inch scale for the lines numbered 1 to 5. Then for any assumed amounts of power generated at *A* and at *B*, and loads at *C* and *D*, the distribution of power in the lines may be obtained by placing charts one upon the other, always remembering that the receiving-end volts for lines 2, 3 and 5 must coincide, that sending-end volts for the lines 1, 3 and 4 must also coincide, and

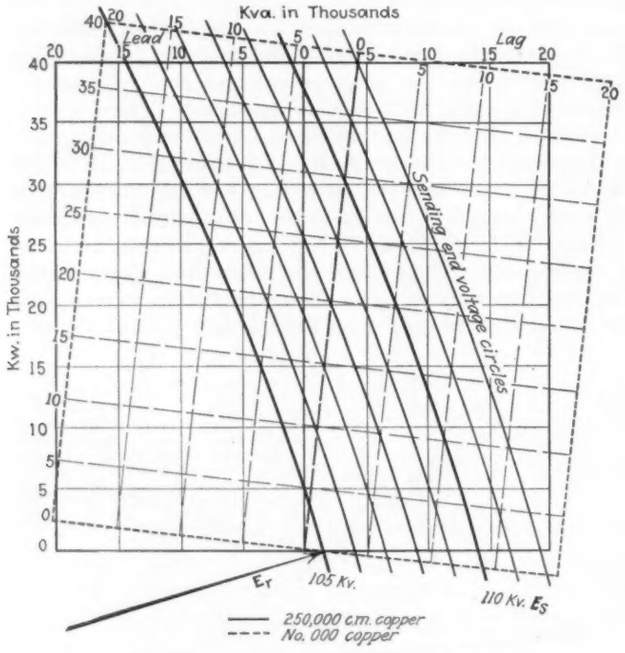


FIG. 2—REGULATION DIAGRAMS OF TWO PARALLEL TRANSMISSION LINES

Charts for the two lines are made to same scale on tracing cloth so that one may be placed upon the other with receiver voltages in coincidence. For any point on a receiver voltage circle the power and power factor on each line may be read from the charts. The charts are for two lines each 50 miles long, one of No. 3/0 copper in dashed lines, the other of 250,000-circ. mil copper in full lines. Receiver voltage is assumed to be 105,000 volts.

that receiver voltage of line 1 is the same in phase and amount as the sending-end voltage of line 2, or vice versa, depending on the assumptions as to sending and receiver ends when the charts were made. The same is true of lines 4 and 5—that is, the angular displacement between the voltages at *A* and *B* and over line 1 plus the displacement between the voltages at *B* and *C* over line 2 equals the displacement between the voltages *A* and *C* over line 3.

In solving a network it is usually permissible to disregard the transmission line losses, as they are rather difficult to include when reading the charts and results are not influenced a great deal by the losses. Accuracy of results by this method depends entirely on the care used in making the charts and in adjusting the position of one chart upon another before readings are made.

Turbo-Unit Added for $16 Per Kva.

IN THE 1925 extension of the South Street station of the Narrangansett Electric Lighting Company, Providence, R. I., a 43,750-kva. steam turbo-generator unit was added at a cost, including condenser, air-cooler equipment and minor auxiliaries, of $687,750. These costs were itemized in an appraisal by Jackson & Moreland, engineers, Boston, on behalf of the New England Power Association in connection with recent proceedings before the Rhode Island Public Utilities Commission, and are presented herewith as based on the company's detailed field outlay.

The turbo-generator consists of a 35,000-kw. (80 per cent power-factor) General Electric unit designed for 1,800 r.p.m., 350 pounds steam pressure and 200 deg. F. superheat, with provision for steam extraction at the eighth, twelfth and fourteenth stages, the generator being of 4-pole, type ATB design and wound for 11,000 volts. A 175-kw., 250-volt, compound-wound 6-pole exciter is also included. The condenser is of the Elliott-Ehrhart twin type, having two centrifugal extraction pumps each driven by a 250-hp., 2,300-volt, three-phase Westinghouse induction motor. The installation also embraces a surface-type air cooler, built in five sections, using fresh water at 90 deg. F., with a rating of 600 gal. per min. at 80 deg. F. and a unit output of 43,800 kva.

ITEMIZED INSTALLATION COST OF 43,750-KVA. UNIT

Turbine, generator and exciter	$499,572
Jet condenser and auxiliaries	45,368
Air cooler equipment	36,203
Lubricating oil system, including one No. 55 Sharples motor-driven purifier and one No. 600 Toval purifier with motor and piping	10,590
Also, one No. 122 Andale oil cooler, type 201F	3,918
Carbon dioxide fire extinguisher outfit, allocated portion of cost assigned to above generator	5,976
Fire extinguisher water and steam lines	2,634
Instrument piping for turbine and auxiliaries	428
Foundation for unit	8,944
Preliminary operation	5,364
Contractor's compensation, 5 per cent	30,950
	$649,947
Condensing water piping from intake tunnel to condenser and thence to discharge tunnel, of 30-in. cast-iron, special fittings	19,178
Contractor's compensation, 5 per cent	959
Instruments	13,835
Spare parts	2,990
Contractor's compensation, 5 per cent	841
Total	$687,750
or per Kva.	$15.72

Tracing Radio Interference

Details of routine method of locating various kinds of trouble. Test set proves value of audio-radio selective hook-up

By James H. Hanly

Radioman Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

IN ANSWERING a radio interference complaint, it is necessary to hear the noise as reproduced by the customer's receiver. If the difficulty is not within the set itself, the troubleman should then start the test set in his car, tune it to the disturbing signal and explore the district as shown in the accompanying diagram. By using such a route the section where the noise is the loudest may be noted. A set which may be used for either radio- or audio-frequency amplification should be employed. Ordinarily the tuning of the set should be done at radio frequency, using the detector rheostat for audibility control. When the point of maximum sound intensity has been reached, the double-throw switch should be placed in the audio position on the set and, by patroling the locality, a point where the alternating-current audio tone becomes distorted can be found. This is the location of the trouble or noise.

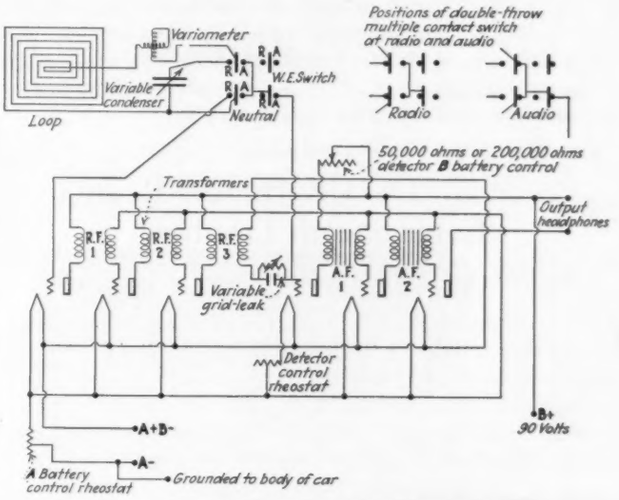
This method of testing can be used on high-tension systems up to 22,000 volts. On systems over 22,000 volts the audio test is not practical, as the electrostatic field is so intense that any radio-frequency components of the trouble are drowned out by the audio-frequency tone. Another reason is that, in most cases, the circuits of very high-voltage systems are placed too high for the loop to enter the field of the radio-frequency component. To lower the filament current of the tubes to a point where the tone may be heard without discomfort lowers the sensitivity of the pick-up and the trouble could never be found. The most successful method of locating trouble on voltages higher than 22,000 volts involves the use of the radio circuit with the audibility control.

When testing at audio frequency the troubleman must become familiar with the various noises so that he will not be confused by those not involved in the trouble. Under a street-railway wire the pick-up of the driving motors can be heard. Although this has been found at times to cause interference, it should be disregarded, due to the fact that although the set is in the field of the trolley, the street car may be miles away. This form of trouble must be found at radio frequency in order to constitute a source of interference. Another misleading noise heard at audio frequency is a "tick-tick" while under a telephone cable or telegraph line. This noise must be disregarded, as it is never heard at radio.

Whenever a case of trouble is believed to come from the street-light circuits, the same method of locating trouble can be used very successfully, but the most effective method is to test every lamp on the circuit. In doing so the troubleman can find all of the cases of radio interference on that circuit. A patrol of the circuit will also eliminate the possibility of its becoming open due to defective street-light fixtures. For this work the audio side of the set must be used at all times.

The most frequent causes of interference from power companies' systems are high-tension insulators, lightning arresters, primaries and arc wires in trees, 2,300-volt insulators, loose plug in primary cutout, and loose or defective street-light fixtures.

The troubleman must be familiar with the various characteristics of every type of wireless receiving set if the weak spots or possible causes of noise in the apparatus are to be located. Loose connections, defective grid leaks, condenser plates touching, low voltage on B batteries, diaphragm too close to magnets in speaker, and defective tubes are among the many causes of noise in a set.

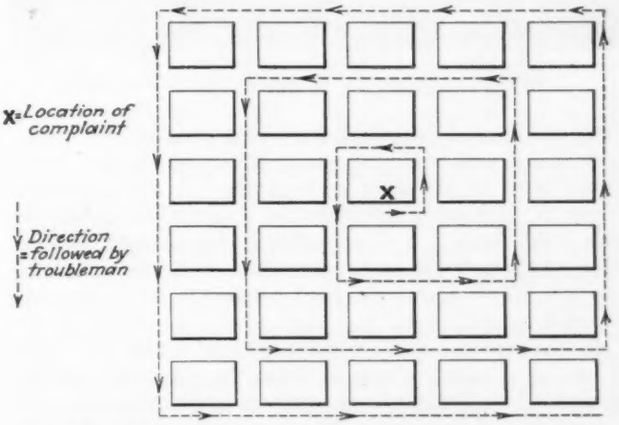


WIRING DIAGRAM OF RADIO-AUDIO RECEIVING SET

Type of Test Set Recommended

The present supersensitive radio receivers require equally sensitive test sets for locating radio interference. Such a set should have two important features. It must be sensitive enough to receive at radio frequency the interference heard by the customer and it must also be able to show the exact location of the trouble. This second feature requires a less sensitive instrument, because a very sensitive test set will frequently pick up the noise with equal intensity over a wide area.

To overcome this disadvantage, the audio-frequency test set was developed. In using the audio testing can be done in the electrostatic field, the set relying on the position of the loop in that field for the amount of pick-up.



GENERAL PLAN OF ROUTE FOLLOWED BY RADIO COMPLAINT MAN

The test set used by the Blackstone Valley Gas & Electric Company for more than a year with excellent results has six tubes—that is, three radio, one detector and two audio. The radio-frequency tubes are coupled by frequency transformers of the untuned type. This

method of coupling makes only the one tuning condenser used to tune the loop necessary. The detector tube circuit is similar to the ordinary set except that a variable grid leak is used which is located on the operating panel.

To change from radio to audio operation a switch is used which at radio connects the condenser across the loop and also connects one side of the loop to the negative of the A battery and ground and the other side of the loop to the grid of the first radio-frequency tube. At audio the loop is short circuited and connected directly to the grid of the detector tube. The total weight of the set complete with batteries is about 20 lb.

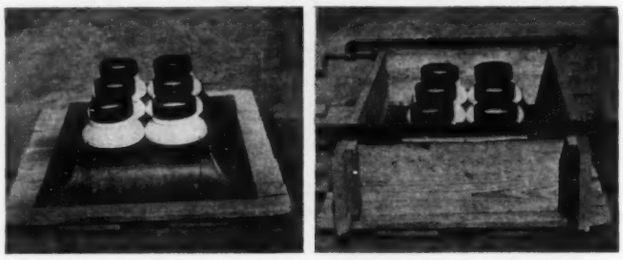
Porcelain Duct Entrances Reduce Cable Sheath Troubles

By William Beauregard* and O. G. Brush†

CABLE sheath troubles have been reduced 90 per cent on the system of the Fall River (Mass.) Electric Light Company by the use of a new design of duct entrance for manhole service. The objective was the elimination of the wear of cables at duct edges, and the experience is based on eight months' service. The equipment consists of porcelain duct bells precast into a concrete block with rounded edges, thus permitting a maximum bend in the cable without fear of sharp corners. Prior to preceasting, the bells are mounted on an adjustable steel form. A fiber collar is cut in half, the cut edge being fastened on the porcelain with a beveled edge upward. This allows the fiber conduit to fit exactly and makes a smooth joint.

FINISHED MANHOLE USING PRECAST DUCT ENTRANCES

In making the mold for the precast block, the form is laid on a wooden base or floor, the sides are boarded up and a 1 to 2 mixture of concrete is poured around the porcelains. After about 48 hours' setting, the form is removed and the precasting is ready for installation. Any desired combination of precast entrances can be made and the bells are designed to fit any size conduit. When installing in a concrete manhole, the precast entrance is mounted at duct elevation and the concrete is poured around. In brick manholes, when the bricklayer arrives at duct level, the precast entrance is mounted and the brick is placed around it. This construction has been found especially useful where springs or water are encountered. The cost is only about 1 per cent of the cost of the manhole on concrete work, and the precasting is usually done on rainy days and in spare time under cover. In the case of brick manholes, it has been found cheaper to install a precast entrance, including the cost of the material, than to brick around the duct entrance.



DUCT BELLS MOUNTED ON ADJUSTABLE FORM AND BOXED IN PREPARATORY TO PRECASTING BLOCK

*Underground Engineer, Fall River Electric Light Company.
†Underground Engineer, Line Material Company.

Welded Buildings Economical, but Experience Essential

"TWO classes of cost savings are secured in welded construction," declared Gilbert D. Fish, consulting structural engineer of the Westinghouse Electric and Manufacturing Company, before the Affiliated Technical Societies of Boston, recently. "There is a reduction in the tonnage of steel required, and there is a saving per ton in the cost of the steel handled. Tonnage is saved by the use of lighter members and the elimination of much connecting material. For example, the five-story arc-welded building at Sharon, Pa., contains 12 per cent less steel than would a similar riveted building. In a welded railroad bridge now under construction at Chicopee Falls, Mass., the amount of steel being used is 33 per cent less than that needed for riveted construction.

"Savings in the cost of handling are due to the fact that a very large proportion of the punching, fabrication and detailing essential for riveting is not needed with arc welding. In an arc-welded building erected at Derry, Pa., 60 per cent of the steel was not fabricated, and the cost of the structure was 12 per cent below its cost if riveted.

"It is expected that welded bridges of the future will prove somewhat more permanent than riveted ones, because the immovability of the joints removes the chief cause of fatigue. Although weld metal is less ductile than rivet steel, a properly designed and executed welded joint should have greater endurance under stress reversals than a good riveted one, because in the case of the latter the connection members and rivets are subject to slight motions back and forth, frequently beyond the elastic limit. Another factor favoring long life for welded joints is their smoothness and absence of rivet heads, with corresponding ease of painting and lessened tendency to corrode.

"Now that arc welding is widely regarded as a coming method which may presently cause extensive changes in structural practice, it is time to sound a warning against

its hasty or ill-considered adoption by those to whom it looks too easy. The opposition that has been faced all along the line by those who have built pioneer structures by welding has forced careful consideration of every step, has called for proof of the safety of every detail and has brought about inspection of more than ordinary thoroughness. With the recent noticeable relaxation of opposition to welded construction, with the rapid awakening of interest among steel fabricators, engineers and architects and with the rising demand by the public that the clamor of the pneumatic rivets be stopped, there approaches the day when bad engineering or bad welding may cause something to give way.

"There is nothing dangerous about welding if proper control is exercised; the only danger is that which is inherent in any new method—the lack of experience on the part of those using it. The steps necessary to insure control are correct engineering, schooling of welding operators and inspection by men trained in that work."

Cooking Schools Prove Value by Increased Sales

By Edward Horry

Vice-President and General Manager Edison Sault Electric Co., Sault Ste Marie, Mich.

THE COOKING school demonstration has been found to be an effective agency to promote the sale of electric ranges. For two years the Edison Sault Electric Company has utilized such demonstrations, usually in the spring, and in these two years it has sold more ranges than in any previous six years. The total number of residence accounts is 2,669. Gas competition is strong. A four-day cooking school last spring brought out an attendance of 557 and six ranges and twelve refrigerators were sold in the three weeks following the school. The sales were made by people coming in and buying, not by high-pressure methods. The refrigerator sales were a by-product of the school.

The school was held in a garage adjoining the power company office, and the entrance was arranged so that attendants passed through the company sales room. The garage was cleaned up and decorated, chairs rented, a platform built and the kitchen set up. The electric refrigerator was placed close to the range, kitchen cabinet and work table, so there was little lost motion. Preparing and cooking the food were demonstrated and explained. Various schemes may be used for creating interest. In the last school there was a cake-baking contest, with 46 entrants, a worth-while prize being offered to the winner.

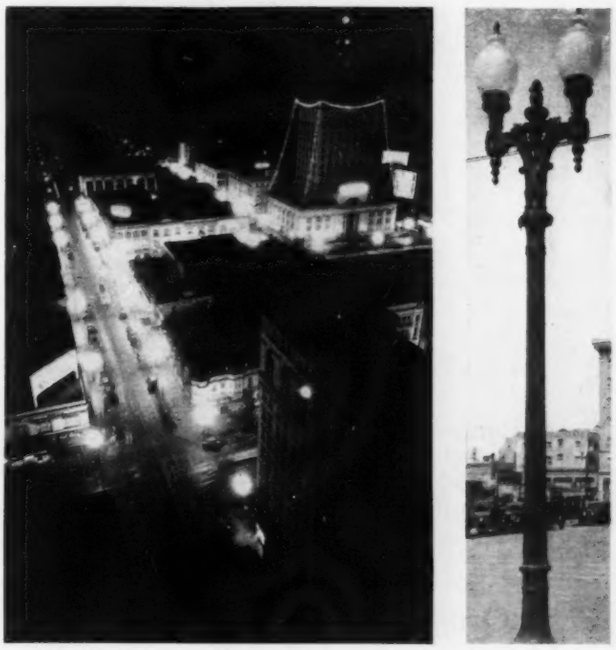
The cost of the 1927 school, except for the demonstration platform, which is available for many other uses, and the cost of cleaning the garage, which is charged only partly to the school because the place needed cleaning anyhow, was $197, including $64.65 for newspaper advertising, $21.61 for cooking and baking supplies, $20.18 for prizes, $17.29 for materials for decorating, $25.39 for labor and $20 for rental of chairs.

It is not possible to assign a figure of total range sales attributable to the cooking school. Its effect is cumulative over a period of years and there is no way of telling whether sales made in December are the results of a demonstration in April or not. However, the management of the Sault company is convinced of the value of these efforts and will continue them. It believes that the independent central station in the small town can accomplish, commercially, as much in proportion as does the larger system.

The Edison Sault Electric Company is perfectly willing to open its files to utilities interested in this subject, if more detailed information is desired.

600 Lumens Per Foot Used on Oakland's "White Way"

EMBARKING upon a comprehensive program for the modernization of its street lighting, Oakland, Calif., recently placed in operation more than 3 miles of white-way lighting in its central business district. Two-light standards numbering 353, of typical Oakland design,



NIGHT VIEW OF OAKLAND'S NEW LIGHTING SYSTEM AND STANDARD POST ADOPTED

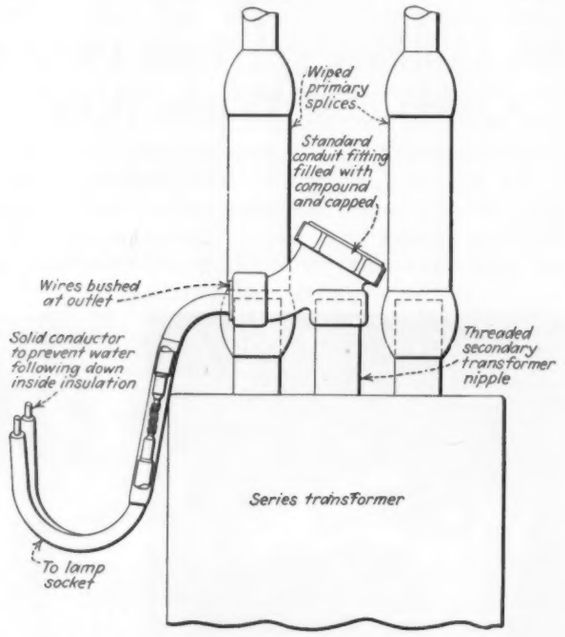
Three post designs that permit competitive bidding have been adopted by Oakland, Calif. The use of these designs has been made compulsory in the interest of uniformity.

are spaced approximately 100 ft. apart, located in opposition on both sides of the street, and are equipped with two 15,000-lumen lamps. The contrast between the new lighting, which gives 600 lumens per linear foot of street, and the old obsolete system is strikingly shown in the illustration.

The new lighting system was installed under provisions of the California state municipal improvement act of 1911 by which the cost of the improvement is assessed against the property owners. The cost of the present lighting system to the property owners was $4.63 per front foot. In addition to the capital cost of the system the property owners pay a part of the energy and maintenance cost. The proportion of this expense that the property owners bear was determined by figuring what the maintenance would be on a lighting system that would be adequate for public safety and convenience and assessing the property owners for the difference between this and the cost of maintaining the ornamental system installed. The base upon which the city figured its proportion of maintenance was a single-light standard with

one 6,000-lumen lamp giving 120 lumens per linear foot of street.

The installation is of interesting design. To avoid the trouble experienced in the past with water following down the low-voltage leads in the post and getting into


Wiped primary splices
Standard conduit fitting filled with compound and capped
Wires bushed at outlet
Solid conductor to prevent water following down inside insulation
Threaded secondary transformer nipple
Series transformer
To lamp socket

COMPOUND-FILLED CONDUIT USED TO PREVENT THE ENTRANCE OF WATER INTO SERIES STREET-LIGHTING TRANSFORMER

the transformers in the base of the posts, City Electrical Superintendent C. E. Hardy specified that the low-voltage leads be taken out from the transformers through a compound-filled conduit fitting. The details of this construction are shown in the accompanying diagram.

Ornamental Street Lighting Construction Costs

THE accompanying tabulation shows the unit and extended prices, less lamps, of the new ornamental street-lighting system at Elmhurst, Ill. Elmhurst is a town of about 12,000 population in the Chicago metropolitan district. The installation includes 893 single-lantern concrete standards; 2,500-lumen and some 1,000-lumen lamps are used.

COST OF ORNAMENTAL STREET LIGHTING AT ELMHURST, ILL.

Classification	Unit Price	Extension
283,000 ft. of trenching, 4 ft. x 10 in., and backfilling	$0.04	$11,320.00
9,900 ft. of 2½-in. wrought galvanized iron pipe under street crossings	0.98	9,702.00
1,300 ft. of 2½-in. wrought galvanized iron pipe under railroad crossings	1.00	1,300.00
Twelve brick masonry manholes installed complete	145.00	1,740.00
107,000 ft. No. 8 5,000-volt parkway cable installed	0.25	26,750.00
359,000 ft. No. 8 2,500-volt parkway cable installed	0.15	53,850.00
893 reinforced concrete lighting standards installed complete	38.00	33,934.00
893 solid bronze octagonal lanterns installed wired complete	44.50	39,738.50
893 post holes 20-in. diameter 4 ft. deep complete	0.90	803.70
47 4.2-kva. branch line constant-current 6.6 amp. subway-type transformers	156.00	7,332.00
One 4 P S T 400-amp. remote-control oil circuit Breaker installed complete	420.00	420.00
Six 2 P S T 400-amp. remote-control oil circuit breaker installed complete	378.00	2,268.00
Twelve 6,600-volt S P combination disconnecting switch and fuse installed complete	52.00	624.00
One 3-kva. 2,300-230/115-volt 60-cycle	62.50	62.50
Six 34-kva. moving coil 6.6-amp. C S STA type regulators	720.00	4,320.00
One length 150 ft. 30-conductor No. 19 wire control cable installed complete	$195.00	$195.00
One slate panel 24x24x1¼-in. drilled for watt-hour meter installed	25.00	25.00
Sixteen cells 400-amp.-hour storage battery, complete with knife switch installed complete	26.00	416.00
One 6-amp., 75-volt bulb-type rectifier installed complete	180.00	180.00
Three 4,000-volt low equivalent lightning arresters installed complete	110.00	330.00
One piece approximately 100 ft. of No. 2 lead-covered four-conductor, 4,000-volt service cable	285.00	285.00
One pipe frame switchboard complete with busbars, insulators, etc.	500.00	500.00
Twelve two-wire, 4,000-volt disconnecting potheads installed complete	22.00	264.00
Six two-wire, 4,000-volt non-disconnecting potheads installed complete	18.00	108.00
One four-wire disconnecting pothead installed complete	38.00	38.00
One four-wire non-disconnecting pothead installed complete	25.00	25.00
One concrete cable vault installed in substation	124.00	124.00
60 ft. of 3-in. iron conduit laid in floor of substation as specified	1.50	90.00
250 ft. of 2½-in. iron conduit laid in floor of substation as specified	1.00	250.00
110 ft. of 4-in. fiber conduit laid in concrete as specified	1.75	192.50
One set portable testing instruments as specified complete	510.00	510.00
One transformer substation building completely erected	3,675.00	3,675.00
Total		$201,372.00

Boiler Plant Equipment Costs

FROM the cost sheets of an eastern power company are taken the following cost data applying to various boiler plant equipment installed about two years ago in a tidewater station extension under excellent engineering supervision. Four boilers with a combined rating of 7,168 hp. were installed with pulverized coal burners, a new stack, and other apparatus. In using these items in checking other work, they should be applied in segregated form, as indicated, and not totaled to obtain the over-all cost of a complete installation. As itemized, the costs given represent outlays actually made with the equipment installed.

MISCELLANEOUS BOILER PLANT COSTS
EQUIPMENT INSTALLED 1925

2	1876-hp. B. & W. cross drum water tube boilers, 385 lb. steam pressure, 18,755 sq.ft. heating surface each; tubes 20 high, 36 wide, 4-in. tube diameter and 10-in. steam outlet	
2	1,708-hp. similar boilers, tubes 18 high and 36 wide; 17,084 sq.ft. heating surface per boiler	
4	B. & W. superheaters, each 120,000 lb. steam per hour to 200 deg. F. above saturated steam temperature at 375 lb.	
	Water screens for powdered fuel furnace tubes 4 in. diam., 14 in center to center, 430 sq.ft. bottom; 599 sq.ft. side walls, 468 sq.ft. rear wall	$325,691
1	Extra boiler drum, 36 in. x 26 ft. 10.5 in., with equipment for testing, 400 lb.	7,551
	Settings for above four boilers, including 9-in. fire brick lining furnace bottom walls and filling top ash gates, rear, side and front walls fire brick and Sil-O-Cel construction	113,725
	Steel sheet boiler casings	40,810
	Diamond soot blower equipment	15,063
	Soot conveyors	12,953
32	Lopulco pulverized coal burners, 8 per boiler	3,975
	Contractor's compensation on above items	25,988
4	Air preheaters, consisting of two 40,000 sq.ft. Ljungstrom regenerative type; one 15,000 sq.ft. B. & W. tube type, and one 14,000 sq.ft. Combustion Engineering plate type, and accessories to Ljungstrom type	104,871
2	50,000 c.f.m. forced draft fans, Sturtevant No. 110, 5 turbovane, driven by 40-hp. variable-speed slip-ring motor, and	
2	110,000 c.f.m. Sturtevant induced draft fans, 8-ft., one driven by 40-hp. motor and one by 200-hp. motor	41,789
	Air ducts	35,982
	Flues and uptakes	17,884
	Combustion control system	27,557
	Steel stack and bonnet, 18 ft. 9.5 in. diameter, 220 ft. high above roof	40,677
	Radial brick lining in upper part of stack 4.5 in.	7,055
	Pulverized coal piping, 700 ft. of 8-in. coal house to bins	32,929
	Coal piping from weigh bins to bunkers (two 8-in.)	12,650
	Weigh bins and testing apparatus	7,006
	Coal pump for testing	6,814
24	5.5-in. multiple type coal feeders, 50-hp. motor each and four 7,500 c.f.m. blowers, 12-hp. motor each	4,302
	Coal piping for testing	3,985

Financing for Service

BOND and debenture financing in its various aspects was discussed in the Dec. 24 issue under the caption, "Financing for Service." The discussion is here continued, with special bearing upon stock financing and the importance of customer sales in public relations.

THE history of the changes leading up to the preferred stock provisions now in almost general use by utility companies is similar in some respects to that of the evolution of the modern open mortgage. These changes have followed amendments to state corporation laws enacted from time to time as experience has dictated their necessity or advantage. While the amount of stock which may be issued is fixed by charter (subject to change by stockholders' vote), this is not a serious handicap, as stockholders' authorization of a warranted increase ordinarily can be obtained, though on occasion special effort may be necessary to obtain it. Preferred stocks usually are now issuable in series, with dividend rate and redemption price determined for each series as created, and ordinarily subject, with respect to issuance of additional stock of any series, to charter provisions prescribing a minimum margin of earnings over dividend requirements and sometimes specifying the relation of total preferred stock to value of assets or to total capitalization. These amplifications have materially facilitated the raising of capital through sales of stock with salutary effect on the disproportion between senior and junior securities formerly existent in the capital structures of many utility companies.

Value of Customer Sales

Since customer-owner campaigns on an extensive scale were undertaken about thirteen years ago, great strides have been made by electric utilities in placing their preferred stocks among investors in the territories they serve. Aside from its effectiveness as a means of regularly procuring funds, this procedure has been advantageous in other important respects. It has aroused a growing interest in and better understanding of the problems of the utilities. Their long records of uninterrupted dividend payments have inspired confidence in their securities as investments, a significant supplement to the confidence in their intent and ability to serve economically and well. General adoption of plans requiring only small installment payments has encouraged small wage earners in increasing numbers to purchase preferred stocks and thereby regularly to save part of their earnings. Attracted by good investment returns, possessors of larger incomes have joined the rapidly growing ranks which now comprise 5,000,000 direct holders of public utility securities.

Not long ago almost any reference to preferred stock issues would have brought to the forefront the question of voting rights, then receiving much attention principally because of opinions expressed by one of the country's widely known economists with particular reference to certain industrial corporations. In the ensuing discussions various theories were advanced, many of them premised on circumstances foreign to preferred stocks of regulated public utilities. More than a year has passed, the air has cleared and now we find ourselves about where we were before a few isolated cases of roundly criticised industrial financing encouraged the many-sided arguments that for a time seemed to stir the world of finance. The supposition that a preferred stockholder is a partner in the business seems to be the principal reason for advocating that preferred stock be endowed with the full voting privilege.

"Preferred stock" implies, at least to most people, a stock having preference over some other stock. If the preferred stock is of the type which has been usual for so long that the mere mention of the term warrants the assumption that it is, it has prior call over the common stock on earnings for the purpose of paying its dividends, and on assets for the purpose of paying the par or otherwise stated amount in the event of dissolution.

Not Partner in Ordinary Sense

The term "partner," used without qualification, implies proportionate sharing of profits and risks, a condition not at all applicable to the holder of a security who must receive the full amount of a stimpulated sum from earnings before any part of such earnings can be applied to the payment of dividends on the common stock, and who, in the event of the winding up of the business, must receive the full amount of a stipulated sum before any part of the proceeds of sale of the assets can be paid to the owners of the common stock erroneously spoken of as his "partners." And, incidentally, it is not unusual, in fact it is quite usual, to find that a so-called "non-voting" preferred stock has voting rights in certain events, such as default in dividend payments and on proposals to increase the authorized amount of preferred stock, create a security having prior rights or to mortgage or sell assets. The holder of such a preferred stock is not, or at least need not be, concernd with the details of management so long as the terms of the contract made with him are met, and particularly when the operations and issuance of securities of the issuing corporation are subject to commission jurisdiction and the corporation is controlled by those who have proved themselves worthy of the trust and able to discharge the attendant responsibilities and who have large actual investments in the common stock. Such a situation is vastly different from that of an unregulated industrial corporation, controlled through the medium of a nominal issue of so-called "management stock" or otherwise by interests that do not own or represent a large actual investment in the stock of the corporation.

Before leaving the subject of voting rights it may not be amiss briefly to comment upon the apparent indifference of stockholders. A review of the records of the voting at stockholders' meetings of large representative corporations over a period of years would probably disclose some highly interesting facts, if newspaper reports on their meetings are indicative of the attitude of the average stockholder. At annual meetings held principally for the election of directors, usually requiring

only the vote of a majority of voting stock, often but little more than the essential majority is represented despite the fact that the stockholder is called upon merely to sign a printed proxy and mail it in an envelope already stamped and addressed. It has often been found necessary to organize campaigns and actively solicit proxies in order to obtain the minimum vote required by statute at meetings at which action is proposed to be taken on special matters of unquestioned advantage to the stockholders. In that connection it is interesting to note that an official of one of the large public utility holding companies was recently told by a stockholder that she would sell her stock if she was to be bothered by having to vote upon any matter. It can hardly be said that such indifference is indicative of dissatisfaction, as serious dissatisfaction if it existed would undoubtedly be evidenced in some manner, perhaps by sale of the stock, if not by direct communication with officials of the corporation.

The amounts of common stock issued by electric utilities in late years have, in the aggregate, represented a greater proportion of their total security issues than ever before, though the procedure has been, in general, somewhat different from that followed in their bond and preferred stock financing.

Methods of Distribution

Bonds usually are sold in blocks to investment bankers, who in turn distribute them to investors. Preferred stocks, when sold in customer-owner campaigns, as has been true in the majority of cases, are disposed of through the companies' own securities departments or regular employes in small lots day after day until the amount of the issue has been sold. On the other hand, it has been the practice among the majority of utility companies to make to their stockholders a single subscription offering of the total proposed issue of common stock, such offerings as a rule being made not more frequently than once a year. Many of the important electric utilities of the country are now either under holding company control or have holding or investment companies among their large common-stock holders, with the result that the holders of the preferred often greatly outnumber the holders of the common stock. The amounts of issues of additional common stock applicable to these large holdings usually are subscribed for in order that proportionate interests in the equities may be maintained. Thus, notwithstanding its importance as a means of obtaining capital, the common-stock financing of the electric utilities has come less before the general public than their bond and preferred stock issues, due to the more concentrated ownership.

In addition to the large investments made from time to time in their common stocks, well-managed electric utilities usually leave in surplus account a considerable portion of the earnings available for dividends on the common stock, such surplus being reinvested in the properties and business. Analyzed from any viewpoint, this policy is conservative and worthy of encouragement, though sometimes the common-stock holders are penalized, or attempts are made to penalize them, for such conservatism. Earnings which common-stock holders are legally entitled to receive as dividends but which the directors wisely elect to reinvest in the business and thereby strengthen the position of the corporation are entitled to earn reasonable returns, just as are the invested proceeds of securities issued to provide for capital requirements. When the reinvested earnings are not capitalized, the result is an increase in the rate of earnings on the common stock, assuming, of course, continuance of reasonable returns on the total investment.

Such situations at times have stimulated the ambitions of those seeking political preferment on any pretext, and encouraged claims of exorbitant charges for services, the accumulated surplus being pointed to as evidence of past excesses, and the high rate of current common-stock earnings as evidence of continuance of the alleged abuses.

As a matter of fact, earnings on the common stock of a utility corporation may reach a high rate while at the same time its entire earnings remain within the limits of reasonable returns. Let us take, as a hypothetical case, a corporation with $10,000,000 of property and $10,000,000 of capitalization consisting of, say, 60 per cent, or $6,000,000, of bonds; 20 per cent, or $2,000,000, of preferred stock, and 20 per cent, or $2,000,000, of common stock. With such a capital structure and a well-developed and growing business, sound rate schedules and policies of management, property in first-class operating condition and satisfactory public and employee relations, the corporation should be able, at least under market conditions similar to those now prevailing, to sell its bonds at a 5¼ per cent annual cost and its preferred stock at a 6¼ per cent annual cost. Earnings equal to the commonly recognized, though not always realized, return of 8 per cent on the $10,000,000 of property would amount to $800,000. After deducting annual interest and preferred dividend charges at 5¼ per cent and 6¼ per cent respectively, there would be available for the $2,000,000 of common stock $360,000, or 18 per cent. If two-thirds of such earnings, or 12 per cent, were paid as dividends on the common stock, $120,000 would remain in surplus, the investment in the business being thereby increased to $10,120,000, on which 8 per cent return would be $809,600. Deducting the same interest and preferred dividend charges would leave earnings for the next year of $369,600, or 18.48 per cent, on the $2,000,000 of common stock. Continuing under the same conditions, at the end of five years the investment would be more than $10,700,000, on the basis of which earnings on the $2,000,000 of common stock would be more than 20 per cent, and yet the rate of return would not exceed 8 per cent. As the corporation issued additional securities the annual interest and preferred dividend charges on the additional securities would, of course, vary from the rates used in the foregoing illustration, according to the investment market conditions prevailing at the time of issuance, with corresponding effect on the rate of common-stock earnings.

Political attacks of the character referred to have been more often directed against companies under holding company control. This was probably because holding companies, before their actual usefulness and important aid in the development of the electric industry were as well understood and as widely recognized as at present, seem to afford targets as so-called "trusts" and "big business," and perhaps, too, because the stronger holding companies were in better position than individual stockholders to permit their operating subsidiaries to retain in surplus and reinvest in the business large proportions of the earnings available for common-stock dividends.

Though earnings are limited to reasonable returns, the assurance of a stable and expanding market for their product or service affords an outlook for soundly capitalized and well-managed electric utilities that warrants the complete removal of their securities from the field of speculation. Many new and important uses for electricity are constantly being found and almost unlimited

opportunities exist for further cultivation of fields already entered. Less than 2 per cent of the railroad mileage of the country is electrified, and electricity on the farm, practically unknown until a comparatively few years ago, is now being extensively applied with great savings to the farmer in money and physical effort. Progress along these lines, as well as extensions into new fields, will entail heavy development costs and make it imperative that ample capital be available when needed from time to time.

Within the past few years there has been a notable tendency toward legislative recognition of the advantages to savings banks and trust funds of investing in public utility securities. This tendency will undoubtedly receive further impetus from the growing necessity of making available to fiduciary institutions additional fields for the safe and profitable employment of their large and rapidly growing funds.

Though costs of labor, material and fuel today are still more than 50 per cent higher than the pre-war levels of 1913, the householder pays about 15 per cent less for his electric current than he did at that time, its cost to him being practically the smallest item in the family budget. Service extensions not supported by immediately available revenues have been made to encourage upbuilding of communities and attract industries, and standards of service have been immensely improved. These accomplishments are the result of research, initiative and able administration and have merited the approbation of the public.

Notwithstanding their creditable records, however, the electric utilities cannot merely rest upon their laurels. It is incumbent upon their executives to pursue diligently possibilities of further improving and extending service and reducing charges; to continue to justify public support of their policies of operation and development, and to protect the investments of those who have supplied and must continue to supply the large amounts of needed capital. The dangers of unwarranted attacks have greatly diminished as the public has come to have a better understanding of the problems and affairs in general of the utility companies, and evidence is not lacking of the confidence of the utility companies themselves that, when conversant with the facts, the public will be fair to the industry that has contributed and will continue to contribute so much to its well being.

Standard Motor Dimensions

SINCE the data were collected for publishing the table on page 1100 of the Nov. 26, 1927, issue of the ELECTRICAL WORLD, giving a comparison of alternating-current motor dimensions the Crocker-Wheeler Electric Manufacturing Company has offered its 50-P motor to supersede the 13-Q motor which was listed. The values for the new 50-P motor corresponding to those listed in the table are as follows:

			Shaft Extension, In.							
Make	Type	Frame	*u*	*n*	*t*	*s*	*k*	*d*	*b*	*2f*
Crocker-Wheeler..	P	50	1¼	4	¼	¼	1⅛	7	10½	8½

Make	Type	Frame	*a*	*2e*	*x*		*m*	*c*	
Crocker-Wheeler.....	P	50	13½	11½	..	6 7/16	6½	16 1/16	13½

In the original Table I the column under shaft extension, headed "*a*," should have been headed "*u*" to correspond with the diagram.

A Grounding Policy That Will Promote Development

By D. HAYES MURPHY
President Wiremold Company

THE grounding policy recommended by the National Electrical Manufacturers Association committee on grounding and adopted by the association will help to clear the air on this subject, definitely present the manufacturers' viewpoint and possibly prevent a multiplicity of rules that may only retard development.

The proper grounding of equipment has always been a matter of diversified opinion, particularly as regards portable apparatus. The vast majority of manufacturers are so absorbed in the problems of their individual concerns that they often fail to grasp the significance of the larger industry problems, such as proper grounding rules, and the direct bearing which these problems have on their private business. To solve these problems it is only necessary that they be presented in such a way that they will receive serious consideration. The merger of the various manufacturing groups into the National Electrical Manufacturers Association has provided a splendid forum for the necessary discussions and means for putting plans into effect.

By making understood a basic problem of the industry such as this grounding question the N.E.M.A. has recorded an achievement. The manufacturers are bound to support such a constructive movement, which is for the benefit of the industry and the general public. This is a distinct step in the right direction and represents substantial progress on the part of the manufacturers in supplying the public with more and better electrical service.

Interesting Transformers Used on Conowingo Project

AT THE hydro plant of the Conowingo project and at the large switching station used in the interconnection developments in this region some large and unusual transformers are installed. The Conowingo plant transformers were made by the General Electric Company and are thirteen in number. Each transformer is rated at 26,667 kva., giving a bank rating of 80,000 kva. Four banks of these transformers and one spare are provided. Water-cooled two-winding units are used, which step the voltage from 13,800 to 220,000.

At the Plymouth Meeting substation, seven transformers manufactured by the Westinghouse Electric and Manufacturing Company are to be installed. These units are rated at 33,333 kva. each and, therefore, provide two 100,000 kva. banks with one spare unit at this station. The energy from Conowingo and that from the Pennsylvania-New Jersey interconnection is stepped down from 220,000 to 66,000 volts. On the transformer units, in addition to the 220,000 and 66,000-volt windings, there is a 13,200-volt tertiary winding. This winding is used for the triple purpose of closing the delta, operating synchronous condensers and operating the tap-changing equipment installed on the 66-kv. side of the transformers.

An interesting feature of the Plymouth Meeting transformers is that they are self-cooled and arrangements are made for impinging air on the radiators to obtain high ratings.

Sales Conference Studying Problems

One committee now engaged in planning adequate wiring campaign. Whole-hearted support needed to carry out plans when formulated

By W. E. Sprackling
Chairman Electrical Industry Sales Conference

IF A MAN is satisfied to let his business run itself, if he does not push it actively because he has heard that we are going to have a fairly prosperous year, his business is headed for the rocks. Likewise, if an industry is willing to sit back and take what is thrown at it without an earnest effort to go out and get something in addition, then that industry is not going to have as prosperous a year as it would have otherwise. In other words, 1928 will be as prosperous as we want to make it.

W. E. SPRACKLING

The favorite indoor sport for business men at this time of year is for everyone to catch the ear of everyone else and wisely whisper therein just what the year 1928 has in store for us. Fortunately for us all, our present national banking system, plus a thorough study of cause and effect on the part of various statisticians and financial agencies, allows us all to shoot fairly close to the mark with our predictions. But all of this information concerns only business in general. It does not mean that every business or every industry will be affected alike. Heaven forbid! Such a thing would mean the burying of initiative—the killing of incentive. It would be a calamity that could not exist.

In the past our electrical industry has been too content to follow the easy-going path of taking what is given to us or at best to pick the business plums that could be reached without effort—let the poor fellow who had to work for a living strain his back for the plums higher up. Now we find that we have grown and need those plums we once scorned. So we all wake up to find that we have with us this "new competition" we hear so much about, and we get together in an Electrical Industry Sales Conference. What to do! Echo answers, "A-plenty." But it can't be done over night. It can't be done in a month. There is no open sesame that will lead us into verdant fields and green pastures. We have got to start in and work for a living. We have got to go back and rework the old fields. We have got to spend some money on fertilizers and new equipment. We have got to do some earnest cultivation of the present market.

The sales conference has decided on one thing which many will say was self-evident—and in that they are correct, of course. The conference said, in substance, "The only way we can sell more current, sell more appliances, more portable lamps, fixtures, transformers and what not, is to have plenty of places in the home to plug in current-consuming devices whether they be two-dollar portable lamps or an electric refrigerator selling at $750." In other words, we must see to it that homes are adequately wired. Therefore the conference appointed an excellent committee representing the best brains in the industry on this particular subject. That committee is now figuring out an "adequate wiring campaign" that will be universal in its operation and nation wide in its appeal.

The committee will have a little more than a month to study the subject, write up its findings and hand in a definite report to the conference at its next general meeting on Jan. 11. That report will call for immediate action. Then the proposition will be placed before the industry as a whole to support the project and help to make the year 1928 more prosperous or else to sit back with that, "let-George-do-it" attitude and wait to see somebody else step forward first and say, "I am with you!" Whatever the plan may be, the industry as a whole is not going to be 100 per cent satisfied with every detail of it. That is one prediction that is easy to make. But whether everyone is sold on every detail of the plan or not, the fact remains that the campaign will be an industry campaign and should be given the whole-hearted support of everyone in the industry.

Another industry problem the conference had put up to it was the problem of the contractor as a group. He is our direct contact with the public as far as wiring installations go. He is at times a fine journeyman, at other times he is only a fair workman; sometimes he is terrible. As a salesman he is a fine mechanic. What to do with him! He is a real problem. And so, the Electrical Industry Sales Conference has taken on this job and has given it to a fine committee that best knows what is needed. It is giving the subject a lot of thought, But its problem is one that is going to take time and patience. No one can expect an immediate solution to that perplexing situation. Suffice it to say that all branches of the industry are joining hands to try to work out an answer.

There are other committees at work as well as the two mentioned. Each has a single broad subject to work on, a particular problem to solve. What does it all mean? Where does it all point? It means that for the

first time the electrical industry is working as a unit, that there is a realization of the need for team play. It points toward a time when duplication of effort will cease, when spasmodic attempts by one group will be replaced by co-ordinated group effort.

But while the Electrical Industry Sales Conference can devise the plan and point out the way, it can never hope to go out and put the campaign across of itself. The actual accomplishment of any plan requires the whole-hearted, active, enthusiastic support of everyone in every group of the industry. And that is just where each one of us will play his part in making not only the year 1928 more prosperous but 1929 even more prosperous than 1928 and 1930 bigger still. We, as an industry, have it right in our own power to make our prosperity just what we will it to be by the amount of time, effort, interest and money we put into the means of bringing that prosperity to us. The extent of our prosperity lies in our own hands.

Favors Support of Flood Control

I THINK there is a good deal of popular misunderstanding as to what can be done in the way of flood control. In the past, control has been accomplished in large measure by natural reservoirs which have been increased moderately in capacity. Such control helps but cannot begin to cope with such a situation as existed in the Winooski Valley of Vermont and several other places last November. We were fortunate that the storm did not extend up and down a principal river valley rather than across several states. Had it done the former, one or more cities might have been drowned out. The flow in some New England streams was so great that had it been in the same proportion in the larger rivers, the latter would have had in them five times the normal flow of Niagara—that is, more than a billion and a quarter second-feet in the case of the Connecticut and the Kennebec.

To store sufficient water to take care of a condition even approaching the foregoing would be a monumental task even on one river. I believe, however, that a great deal can be done to take care of all ordinary freshets and that there are places on most New England rivers where more water can be stored than we have ever considered possible before if we have co-operation among the different affected interests. A great deal can be done if we can get even a large part of the people interested in any one river. I do not believe that we ought to do it through the federal government, except possibly in the case of immensely large rivers, and even with these, if feasible, the work should be done by the states or by interests working within the states and not by the national government.—WALTER S. WYMAN.

Customers in Canada, 1924 and 1925

A RECENT report on central electric stations in Canada, published as a portion of the Census of Industries, 1925, by the Dominion Bureau of Statistics, indicates that there were 1,279,731 central station customers in Canada at the close of 1925. This is an increase of 6.7 per cent over the number at the end of 1924.

In the last year for which statistics are available, there was an increase of about 8 per cent in the number of residential lighting customers and 2.6 per cent in the number of commercial lighting customers, but a slight decrease in the number of power customers. This decrease was confined to the three provinces, Quebec, Manitoba, and Alberta. Taking the country as a whole, the number of domestic lighting customers is about 50 per cent of the total number of families; in the most populous province, Ontario, it runs up to 55 per cent.

Census Bureau Asks Co-operation

OPERATIONS of American industry are once more to be surveyed and counted by the federal government. The next biennial census of manufactures will cover data for 1927. Until 1919 these industrial censuses were taken every five years, but at the close of 1921 the biennial census of manufactures was instituted. Such an advance in the collection of general production data is in line with the new economic era under the influence of which business and industry has been functioning since the war period. The success of the government in this task will depend almost entirely upon the co-operation received from manufacturers in furnishing the basic data required. The Census Bureau states that manufacturers of the nation can render a real service to industry by returning the government questionnaires just as soon as the basic data are available. The Census Bureau stands ready to do its part immediately the figures are received from the manufacturing plants. The value of the present census of manufactures, therefore, depends upon the co-operation extended by the manufacturers in making early reports of 1927 operations.

Timely data on both production and distribution are absolutely essential to the fullest development of business and industrial management, elimination of waste, both material and physical, standardization and research; and the more timely the data, the greater their value. In the past it has been impossible for the federal Census Bureau to collect, tabulate and make public the complete basic data on production under a year and a half, although data on some special industries have been issued within a year after the taking of the census. The Census Bureau is making every effort this year to make the summary figures available many months ahead of the previous censuses.

Rural Rates Raise Usage 68 Per Cent

FARMS receiving service from transmission lines in Wisconsin increased during the year ended June 30, 1927, from 9,945 farms to 13,749 farms—an increment of 3,804, or 38.2 per cent. Utilities are not looking necessarily toward the increase of farm customers so much as toward the class of farm connected. They seek increased load density, of course. That the approach of near uniform rate structure is having its effect may be seen in the following: One utility studied the accounts of 2,354 customers on its farm lines. Where modern rate structures have been put into effect, the result of this survey indicated the following average kilowatt-hours per month:

First half of 1925, average kilowatt-hours per month	35
Second half of 1925, average kilowatt-hours per month	37
First half of 1926, average kilowatt-hours per month	44
Second half of 1926, average kilowatt-hours per month	59

Another study was made of 36 customers, whose old records before the application of a modern rate structure

indicated an average of 48 kw.-hr., whereas, after the application of the new rate structure, the average increased to 116 kw.-hr., an increment of 142 per cent. One farmer averaged 606 kw.-hr. per month in 1925 and 1,024 kw.-hr. per month in 1926. Recently a line having 38 rural customers was analyzed with the following results:

Number of customers	38
Total kilowatt-hours in 1925	9,563
Average kilowatt-hours per year	251
Total kilowatt-hours in 1926	12,533
Average	329
Kilowatt-hours in 1927 (seven months)	23,839
Average	627

This shows an increase of 90.5 per cent for seven months of 1927, as compared with twelve months in 1926.

Benefit of Commercial Approach

These figures support the opinion that new customers begin service better educated to the value of electrification on the farm than do old customers. Their consumption starting from the outset at monthly figures is greatly in excess of that of old customers. One rural customer recently added to a rural line was properly approached by the commercial department in that area and placed an order for the following equipment: One refrigerator, one washing machine, one vacuum cleaner, one ironing machine, one electric iron, one toaster, one percolator, one electric range. It is easy to understand why this customer's first meter reading indicated a consumption of 363 kw.-hr.

Letters from Our Readers

District Representative Plan Misunderstood

To the Editor of the Electrical World:

I note on page 1311 of your Dec. 24 issue that the writer of the article is laboring under the impression that the Stone & Webster district "representative plan" is primarily for the purpose of selling appliances, instead of what it really is: A complete and adequate "service" established for the purpose of promoting customer understanding and appreciation by a complete, well-rounded and satisfactory effort adequately to serve the public.

To render this complete and satisfying service, among other things the district representative plan substitutes an intelligent, high-grade and adequately trained district representative, whose first duty is to see to it that customers in his district receive adequate and satisfactory service. The representative reads the meters, which duty becomes a means of frequent and systematic contact with the customer, thereby rendering the superior service to be expected from a really competent person. A woman commentator has recently stated that women always like to do business with people whom they know and whom they can trust. The carefully selected and trained district representative fulfills this need.

The kilowatt-hours sold to the average residence customer may be accepted as a practical measure of the satisfying service rendered by the utility. To sell and deliver a large number of kilowatt-hours, the home customer must possess reliable appliances, so satisfactory that they will be in constant use. The practical way promptly to bring about this condition is to see to it that the home customer is induced to purchase the kind of equipment necessary, which will be used because its use is an advantage.

If the utility does not see to it that this is done, development and revenue will lag with the result that customer understanding and appreciation of the service rendered to the customer, as well as good public relations will suffer. If the utility relies only upon other sales agencies than its own, whose sole interest is from the standpoint of merchandising profit, and if it does not lead in sales activities, there is a lack of prompt and adequate development of the service.

The sales effort is but one of several important duties of the district representative. Thorough, systematic and well-directed effort result in better public understanding and appreciation, which is one of the great benefits derived from the district representative plan. Customers recognize and welcome the district representative plan as a superior service and not as a selling scheme, although large sales result. Such an inexcusable episode as that detailed in your editorial "Good Intentions Gone Wrong" (Dec. 31, 1927, page 1335) could not happen under a bona-fide "district representative" plan.

Norman T. Wilcox.

Principles Underlying Economical Water Heaters

To the Editor of the Electrical World:

I have been interested in the article appearing in the Nov. 19 issue of the Electrical World entitled "Electric Water Heating" because I have developed equipment of this kind for use on our central heating plant, using steam as the heating medium. I believe all of the arrangements shown in the illustrations could be modified to give an adequate supply of hot water from much less energy.

I have found that if the water is heated very hot, only a very little is necessary; but if not heated so hot, each user will run off a great deal of warm water in the hope of obtaining some that is hotter, resulting in a great waste of heat. To take advantage of this condition, a small amount of water should be heated very hot in the top of the boiler with as little transfer of heat to the bottom as possible, the heater gradually increasing the depth of the very hot water to act as a reserve supply. By having the cold water enter the side of the boiler near the bottom in place of the top, this condition will be greatly improved as to all three of the designs shown.

The heater shown in the third illustration on page 1046, inserted through the side of boiler about half way up, will have to heat all the water above it before any warm water is obtained, while the space below it will be found nearly useless. The heater on the outside, shown in the center cut connected with circulating pipes, will work well when new, but the bottom circulating pipe will gradually get stopped up with dirt, resulting in an overheated heating element and a very poor supply of hot water. The heater inside the boiler and surrounded by a tube would be almost perfect if the tube could be made large and of a non-heat-conducting material, perhaps one tube outside the other with an air space between. If the tube is just an ordinary metal tube, most of the boiler will have to be heated before any real hot water is obtained at the top.

Lewis Jones, Jr.

Overbrook, Pa.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Pressure, Temperature and Efficiency of Condensing Turbines.—E. A. KRAFT.—A general consideration of the theoretical features involved in the design and thermodynamics of modern turbines. The author has considered the various conditions accompanying adiabatic steam expansion from different initial pressures and under varying degrees of superheat. The bleeding of steam turbines for the purpose of preheating feed water has been considered in relation to the thermal efficiency of such practices and in connection with preheating of the steam. Resuperheating of the steam under theoretical and practical conditions and under various adjustments of operating factors, receives attention. It is stated in conclusion that so far as constructional and shop practices, materials and operations permit, it may be maintained that perfection in the design of steam turbines has been nearly achieved.—*A. E. G. Progress, (Germany)* November, 1927.

Water Softening Practice Developments.—CHARLES P. HOOVER.—The author has classified the developments in water softening processes according to the following orders: handling of chemicals, mixing devices, Dorr clarifiers, methods for further reducing hardness, substitution of zeolite for soda-ash to remove non-carbonate hardness, and recarbonation. The advantages and practices involved in the pneumatic handling of materials and the application of the chemicals to the water are reviewed and the types of mixing tanks or agitating devices, as well as the disposal of sludge produced as the result of this softening process, and a discussion of the relative stabilization of the softening effect with various types of hardness, are included. A brief consideration of the desirability of using aluminum salts to avoid the incrustation of sand grains through which the water is filtered has been added.—*The Canadian Engineer,* Nov. 15, 1927.

Pulverized Fuel.—The serial report of the Prime Movers Committee of the National Electric Light Association includes statements by operating companies utilizing pulverized fuel giving data regarding operating results and maintenance factors. Information received from manufacturers has been included in this report, and developments in design and operation, accompanied by suggestions, are offered by the equipment companies. The committee concludes that there is an increase in the use of turbulent type burners, preheated-air and water-cooled furnace walls, and that the unit system presents some advantages over the central system, although not without its own limitations and that comparative data regarding the two methods should be available within the next year. The statements by operating companies contain data on energy consumption, pulverized coal, boiler ratings, boiler efficiency and maintenance.—*Report, National Electric Light Association,* 1927.

Electrophysics, Electrochemistry and Batteries

The Generation of Electricity Direct From Heat.—T. F. WALL.—A discussion of some laboratory experiments in the production of electricity directly from heat and an analysis of the results obtained as a result of such tests. The author states that, in view of the great advances which have been made in recent years in the production of heat resisting alloys and the work which has been successfully accomplished in protecting metals from corrosion, the thermal-electric generator has been brought within the realms of commercial feasibility. As the result of these tests, it has been established that a practical form of generator will have the hot junction maintained at the very highest temperature possible. It is further essential that the internal resistance of such a generator shall be as low as possible. These two fundamental requirements form a basis for the design in practical form of a thermal-electric generator. The author's experiments have led to the general conclusions that a gas-ring heated thermal-electric generator cannot be expected to have such a high average thermal efficiency as a coke-fired generator. The definite convenience and ease of control make a gas-ring generator a useful substitute for small accumulators, particularly for such purposes as these where a steady source of electromotive force is required. This type of thermal-electric generator may provide a valuable means for charging electric storage batteries. For a coke-fired generator, the values of the thermal efficiency become from 3 to 4 per cent, when the generator is delivering its maximum output, and 12 to 16 per cent when the generator is short-circuited.—*The Electrical Review—(England),* Nov. 18, 1927.

High-Frequency Currents.—E. W. MARCHANT.—A general discussion of the characteristics of high-frequency currents is offered in this article. The oscillatory discharge of a condenser, the Faraday-Mossotti theory of polarized particles, the magnetization of iron at high frequencies, the high frequency surges in electricity-supply networks, the production of electric waves by high-frequency currents, the determination of the power factor of a dielectric from the cyclogram and a method of showing magnetization curves with a cathode-ray oscillograph, are all considered.—*The Journal of the Institution of Electrical Engineers, (England),* November, 1927.

Generation, Control, Switching and Protection

Sudden Short Circuit of Alternators.—SADATOSHI BEKKU.—The mathematical solution of the problem involving a sudden short circuit upon a symmetrical three-phase alternator may be obtained by solving the simultaneous differential equations. The author has applied the linear transformation of the method of symmetrical co-ordinate and the fundamental differential equation assumed minimum complexity. Heaviside's expansion theorem was applied to this case and the actual computation involved few difficulties. The mathematical solution of the problem involved in the case of the ordinary salient pole alternator upon sudden short circuit was found to be too complicated for ready solution but was verified from experiment which indicated that the machine may be treated as the ideal symmetrical alternator of appropriate electrical constants, without causing any serious error. The concept of the equivalent symmetrical alternator is convenient for the study of transients and the constants may be determined by various measurements. The three-phase short circuit current may be considered to consist of damped, direct current components, tending to zero, and the damped alternating current components tending toward the sustained short circuit current. The damped alternating current component may be considered as the constant induced voltage provided by the variable positive phase sequence impedance. From calculations and tests the assumption has been verified that the transient positive phase sequence impedance just after the occurrence of short circuit is practically equal to the sustained positive phase sequence impedance of the alternator. The latter is constant for the sudden application of negative phase sequence voltage. The author concludes that the short circuit current of the ordinary alternator may be calculated from several measured data, which are open circuit tests, short circuit tests, stator resistance and negative phase sequence impedance.—*No. 203, Researches of the Electrotechnical Laboratory* (Tokyo).

Illumination

Improved Designs for Stage Lighting Equipment.—W. C. BROWN AND F. M. FALGE.—Developments in types of theaters and of presentation, as well as the growth of syndicate management, have brought about notable improvements in stage-lighting facilities. The authors have summarized the limitations of older practices in stage lighting, the requirements of the various classes of equipment and the characteristics incorporated in modern design. The discussion is limited to general stage lighting and does not treat of the important class of operations utilized for a special

effect. Footlights, overhead lighting, proscenium borders, border lights, cyclorama lights, floodlights and spotlights are all considered in connection with their use for achieving the desired illumination. Suggested balances in illuminating effects have been made specific in several instances. — *Transactions of the Illuminating Engineering Society,* 1927.

Farm Lighting.—W. C. BROWN.—The principles and construction methods involved in the satisfactory illumination of farms, houses, barns and outside areas is the subject of this bulletin. A general exposition of the principles of good lighting as related to the sufficiency of light and the elimination of glare, as well as the correct size of reflector for the type of bulb required, and the selection of lamps of the proper voltage, receive specific recommendations for the lighting of each of the structures found on farm properties. The lighting of the farm home, including the various rooms, hallways, passages, etc., is discussed, and recommendations for the installation, wiring, wire size and general construction are made—*Bulletin No. 53, National Lamp Works.*

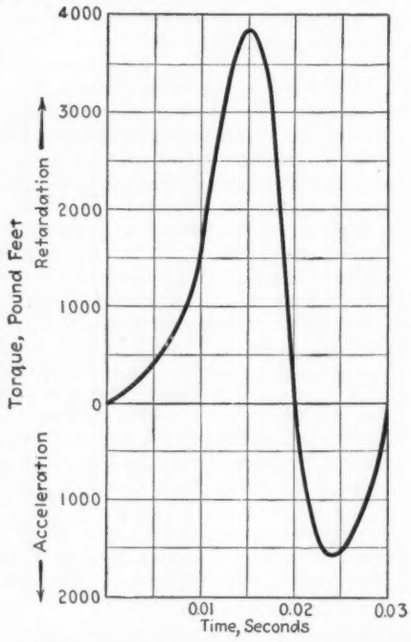
Transmission, Substations and Distribution

Hollow Conductor for 220/380-Kv. Line.—D. I. FUCHS-RIEKS.—The Rhine-Westphalian double-three-phase transmission line has a length of 125 miles and will operate at 380 kv. A hollow copper cable, made of two layers of rectangular strands, wound over a twisted copper ribbon was chosen. The outside diameter of the cable is 1⅝ in., and its weight is 14,400 lb. per mile. Complete mechanical tests were made in the laboratory on sample pieces of this cable to establish its safety. An ultimate rupturing strength of 29,500 lb. was measured. The cable was shipped on large drums, each holding 6,700 ft. in one piece. A number of interesting details are given, describing the method of installing this heavy cable on the high steel towers of the line. Thirteen long-span river, valley or road crossings had to be provided. Ten-disc insulators of either single or double string type, equipped with a top and bottom ring equalizer, insulate the six lines from the towers.—*Siemens Zeitschrift,* October, 1927.

1,000-kw. Complete Automatic Portable Sub-station for British Columbia Electric Railway Company.—In an endeavor to secure an adequate source of reserve equipment to insure complete continuity of service, a 1,000-kw. automatic sub-station was mounted upon a flat car and a superstructure built around a portion of it. This installation consists of a 1,000-kw., 600-volt, direct-current, 6-phase, 60-cycle rotary converter; 1,100 kva., 3-phase, self-cooled transformer, adaptable to converter voltages of 34,500 and 11,500; a motor-operated high-tension oil circuit-breaker and all accessories, including alternating current and direct current lightning arresters, gang-operated air-break switches, and two service-restoring 1,000 amp., direct-current feeders. The converter and switchboard are inclosed, while the transformer, oil circuit-breaker and other high-tension apparatus is of the outdoor type and is mounted on the uncovered portion of the car. The station is full automatic, being started and stopped by load demand. It is fully protected against low voltage, phase failure, phase reversal, alternating current overload, direct current overload, overheating of the converter windings, overheating of the converter bearings, reverse polarity, overspeed, phase unbalance, loss of field, and direct current reverse current. The power transformer and instrument transformers may be connected to operate either from an 11,500 or a 34,500-volt line.—*Electrical News (Canada),* Nov. 15, 1927.

Units, Measurements and Instruments

An Instrument for Measuring Short-Circuit Torque.—B. W. PENNEY.—It is stated by the author that the torque produced by a short circuit, or other transient will cause a corresponding acceleration of the rotor of an electrical machine. If the rotor is not connected to a load, the acceleration will be directly proportional to the torque. A small instrument is described which can be attached to the end of the shaft of the machine to be tested. This device records the instantaneous acceleration of the rotor, the corresponding torque being calculated. The acceleration is measured by two separate methods. The first method gives points on an acceleration time curve, and the second gives a continuous record of the torque. The change in velocity is recorded on the oscillogram, so that, by using a six-element oscillograph, a simultaneous record can be obtained, showing both the acceleration and the short circuit currents. The mechanism for closing the short circuit at the desired point of the voltage wave and the method of checking the accuracy of the instrument are described. The instrument can also be used for measuring sudden shocks to motors and other rotating machinery.—*Journal of the American Institute of Electrical Engineers,* November, 1927.



TORQUE-TIME CURVE FOR A SINGLE PHASE SHORT CIRCUIT

Telegraphy, Telephony, Radio and Signals

The Development of the Televox.—R. J. WENSLEY.—Automatic substation control may be secured by means of a recently developed device, without the necessity of any communication wire other than the customary telephone line. When the telephone bell rings, this instrument lifts the receiver and a characteristic musical note indicates the receptive condition of the apparatus. A buzzer at dispatching headquarters emits a tone of definite frequency and a sending of the desired number of impulses will cause the proper circuit to function. Operation is then secured through the use of a tone of another frequency and upon completion of the transaction, the machine cuts itself off. The dispatcher's phone is entirely free from attachments, as is the receiving phone in the substation. This device is not limited to local exchange service, but may be used over toll lines, thus enabling the centralized operation of extensive transmission systems with no expense other than toll charges.—*The Electric Journal,* December, 1927.

Miscellaneous

Structure of a Protective Coating of Iron Oxides.—RICHARD M. BOZORTH.—This investigation constitutes an X-ray analysis of a Bower-Barff protective coating on iron, showing the chemical constitution and order and thicknesses of the three layers composing the coating. In the preparation of this coating the iron was heated to 730 deg. F. in an air-tight furnace and brought into contact with steam for about an hour, cooled slightly in the air, reheated to 715 deg. F. with steam again for another hour and cooled in the air. This method produced a coating between 0.1 and 0.3 mm. in thickness. Chemical analysis of this coating cannot determine definitely the amount of any phase because it cannot determine what phases exist. The X-ray analysis described by the author does, however, not only distinguish between the three oxides and give a means for estimating roughly the amounts of each present, but also permits the determination of the position of any phase relative to the other phases and to the iron on which the coating is formed. This analysis shows that three oxides are present in layers parallel to the surface X-rays of two wave lengths of different penetrating power are reflected in turn from the surface of the sample. The relative positions of two layers, each composed of one oxide, can be determined from the relative intensities of lines due to each oxide on photographs taken with iron and copper.—*Reprint* B-247, *Bell Telephone Laboratories, Inc*

Book Reviews

Engineering of Power Plants

By R. H. Fernald and G. A. Orrok. Third edition. New York: McGraw-Hill Book Company, Inc. 663 pages, illustrated. Price, $5.50.

In the revised edition of this good text on power plants the authors have done a fine job. This book has been notable in that it gives cost values and dimensional figures for power-plant equipment, and therefore a big task looms up when these data come up for revision in new editions. It takes daring to put cost figures on power-plant equipment, and the authors warn their readers that the values are only relative or approximate; but it is good engineering to use tangible data in colleges and it is a good idea to introduce economics into power-station classes. Accurate data are not needed to bring out methods of economic analysis in the selection of power-plant equipment.

Twenty-six chapters in this book outline the whole power-station field as it exists today and introduce to readers the equipment available and the present practices in power-station design. All through the book an economic and commercial rather than a theoretical point of view is found. The authors discuss power plants in terms of equipment or of application, and general considerations are brought out whereby the element of common sense is developed in the student. While primarily a college text book, there are many engineers who will find the new edition very valuable.

Direct Current

Vol. I. Second edition. By Chester L. Dawes. New York: McGraw-Hill Book Company, Inc. 582 pages, illustrated. Price, $4.

In the second edition of this text the author has revised several chapters, added new material and inserted new problems. It is a companion volume to his work on alternating currents and is notable for its clear and logical presentation of the subject matter. Fundamental definitions and measurements are accented, and the material is of sufficient scope to cover the subject thoroughly. The measurement chapters, the magnetic-circuit treatment and complete material on batteries are features of the text. A larger set of new problems will add to the value of the new edition.

Hochspannungstechnic

By Arnold Roth. Berlin: Julius Springer. 534 pages, 437 illustrations, 3 inserts, 75 tables.

To a considerable extent practice has anticipated theory in the design of high-tension apparatus, in the author's view, the insulation being simply strengthened at points found to be weak until it stood up under operating conditions. This is ascribed to the circumstance that theory dealt with certain assumed ideal conditions—for instance, smooth cylindrical conductors for transmission lines—whereas in practice these had slight projections or rough places favoring dielectric breakdown. In machinery local overvoltages caused failures and were combated by practical measures before their cause was fully appreciated. The purpose of the present volume is evidently to give a physical picture of what is known to occur, by a liberal use of oscillograms, photographs of arcs and flashovers, and diagrams, rather than to present mathematical theories. Formulas are by no means absent; discussions of line oscillations, traveling waves and reflections are scarcely conceivable without the use of equations, but the latter are here simplified by omitting minor factors or terms, and are thus kept out of the realm, for instance, of hyperbolic functions. The book should be particularly helpful to the reader who wants to visualize the mechanism of high-tension disturbances, perhaps as an introduction to more highly analytical treatises.

Rotary Converters: Their Principles, Construction and Operation

By E. P. Hill. New York: D. Van Nostrand Company. 329 pages, illustrated.

Principles and operating characteristics of rotary converters are treated in this book and design details are subordinated. It is a reference book for students and a very good book for engineers concerned with the purchase, testing, installation and operation of rotary converters and auxiliary equipments. Some design formulas and a large amount of basic theoretical matter are supplemented by good graphs, photos and commercial data. Transformers for rotary converters, starting methods and equipments, service operations, operating characteristics, and specifications and tests are fully treated. The book is a welcome addition to the existing literature on the subject matter.

Thermionic Phenomena

By Eugene Bloch. Translated by J. R. Clarke. New York: E. P. Dutton & Company. 145 pages, illustrated. Price, $2.50.

The phenomena of electrical conductivity in the neighborhood of substances which are heated to a sufficiently high temperature are discussed in this book by Professor Bloch. Recent theories and researches are incorporated, especially those of Dr. Langmuir. Thermionic emission from hot substances has afforded study for scientists since 1895, and since 1910 it has supplied engineers with many new and valuable tools. Yet today, aside from a few principles, the phenomena still baffle scientists in large measure. Quantitative values are inaccurate, and what actually goes on cannot be explained on a qualified basis. Metals and salts give thermionic emissions which can be measured and studied. This is a surface phenomenon, resulting from ionization as generally accepted, but the laws of dissociation of ions, with temperature, materials, pressure and other variables, remain to be fixed accurately.

Fortunately the vacuum tube, the radio tube, the X-ray and other devices relying upon thermionic emissions have been developed and can be used. Many more useful devices lie in the future. In this little book the subject of thermionic emissions is outlined briefly in theory, in experimentation and in practical application. It is a good book to read to get a bird's-eye view of a new development in engineering.

Electric Currents in Telephone and Telegraph Conductors

By J. A. Fleming. Fourth edition, revised and extended. New York: D. Van Nostrand Company, Inc. 415 pages, illustrated.

In the new edition of this excellent book Professor Fleming has revised and brought up to date the material of the older editions and has added a new chapter to treat of nickel-iron alloys, thermionic repeaters and other new developments. Carrier telephony, phantom-circuit applications and a consideration of inductive co-ordination add to the completeness of the book. This volume has long been notable for its praiseworthy presentation of a very difficult subject approached mathematically.

The late Oliver Heaviside and other writers used complicated mathematics, but Professor Fleming, using methods developed by Professor Kennelly, developed a treatment which can be understood without great labor. The book has long been a reference work and textbook for American colleges, and the new edition will be welcomed.

Books Received

Electrical Power Transmission. By E. A. Loew. New York: McGraw-Hill Book Company. 388 pages, illustrated. Price, $4.

Mathematisches Praktikum. By Dr. Horst von Sanden. Leipzig: B. G. Teubner. 122 pages, illustrated.

Physikalisch-Technischen Reichsanstall. Berlin: Julius Springer. 642 pages, illustrated.

Commercial Survey of the Southeast. By John M. Hager. Washington, D. C.: Government Printing Office. 477 pages, illustrated. Price, $1.

Mechanical World Year Book. Manchester, England: Emmott & Company, Ltd. 348 pages, illustrated. Price, 1s. 6d. net.

Emile Berliner, Maker of the Microphone. By Frederic William Wile. Indianapolis: Bobbs-Merrill Company. 351 pages, illustrated. Price, $4.

Electric Control Gear and Industrial Electrification. By William Wilson. New York: Oxford Press. 336 pages, illustrated. Price, $8.50.

News of the Industry

Honor Paid to W. W. Freeman

James H. McGraw Award Medal for Co-operation Presented to Him at Banquet Attended by Many Prominent Executives

A DISTINGUISHED company of electrical men paid tribute to W. Winans Freeman on Tuesday evening at a dinner given at the Hotel Roosevelt, New York, on the occasion of the presentation of the James H. McGraw Award medal for co-operation. Prominent executives of the central-station, manufacturing, jobbing and contractor-dealer industries, to the number of three hundred, from Eastern points and as far west as Chicago, gathered to express the approval of the industry of the outstanding service rendered by Mr. Freeman in accomplishing the reorganization of the Society for Electrical Development, by which its directorate has been made officially representative of the major national associations of the industry. It was in recognition of this that the medal was awarded.

Mr. Freeman is chairman of the Union Gas & Electric Company of Cincinnati, vice-president of the Columbia Gas & Electric Company, New York, and for eight years has been president of the Society for Electrical Development. The speaking program constituted a symposium by the executives of the organized industry, Howard T. Sands speaking for the National Electric Light Association, Clarence L. Collens for the National Electrical Manufacturers' Association, George E. Cullinan for the Electrical Supply Jobbers' Association, Joseph A. Fowler for the Association of Electragists and J. E. North for the League Council.

P. G. Gossler, president of the Columbia Gas & Electric Company, paid a personal tribute to Mr. Freeman, and Owen D. Young, chairman of the General Electric Company, eulogized the practical ideal which is the basis of the McGraw Award, the recognition of the service of individuals in the advancement of the industry.

Mr. McGraw, in presenting the medal and purse, further developed this theme. He said:

The greatest problem in our highly specialized business world of today is the development of men. If highly organized corporations are so dependent upon individuals for the necessary enthusiasm and initiative, how much more urgent is the need of the great industry? In a close-knit business organization there are many practical incitements and rewards for original thinking and the independent exercise of resourcefulness and responsibility. But the work men do in the broad interest of an industry finds no such ready recognition and recompense. The time most men give to association activities is usually wrested from the day's work and is only accomplished by personal sacrifice and an increase of the loads they carry.

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W. W. FREEMAN

It is impossible, however, to overestimate the importance of national policies and purposes in the affairs of an industry. National ideals and ethics inspire broad, embracing programs that can only be accomplished as a product of co-operation. They influence the results which both the local and the company policies may be expected to effect. Such ideas as standardization within an industry, elimination of waste through simplification in the number of excess and duplicating varieties of manufactured products, uniformity in terminology, co-ordinated or co-operative sales campaigns and a dozen other expressions of industry co-operation could never have been initiated or established but for the leadership of men who were willing to take time from their own personal and company affairs to work for the co-operative development of the common purposes of the industry in which they were engaged.

It has been an unfortunate and perhaps a costly thing to industry that it has been so difficult in the past to recognize contributions made by men in association work or as individuals. There has been no official time or place nor appropriate occasion in which their services to the industry could and would be acknowledged and publicly recognized as a natural expression of the industry's appreciation. We must strengthen the appeal of co-operative work among eligible men, and if we are to develop this we must find many ways in which the individual may find the rewards that come through the attention, the understanding and the sympathy of the industry for which he works, without which he cannot find full satisfaction and feed the fire of his spirit. I hope that through the years to come these awards may assist in encouraging men to think for the broader interest of the industry at large.

Mr. Freeman received an ovation. In responding he dwelt upon the promise of broadened opportunity now opened to the electrical industry through the closer unity that has been effected between the national associations. He modestly insisted that the credit for the accomplishment should go to his associates on the directorate of the society and to the staff.

Charles L. Edgar, president Edison Electric Illuminating Company of Boston, was chairman of the dinner committee. Frank W. Smith, vice-president United Electric Light & Power Company, New York, was toastmaster.

Mr. Freeman was selected for the award by judges representing the four branches of the industry—J. E. Montague, S. L. Nicholson. G. E. Cullinan and James R. Strong. The following citation accompanied the medal presented to Mr. Freeman:

W. Winans Freeman, chairman of the Union Gas & Electric Company, Cincinnati, and vice-president of the Columbia Gas & Electric Company, New York, as president of the Society for Electrical Development for eight years, has been an outstanding leader in the cause of co-operation in the electrical industry. He came to head the society at a time when, owing to a lack of official tie-in with other industry organizations, it was an imperfect instrument. But the time was not then ready for an actual affiliation between the national groups, for electrical men had not yet become convinced of the industry's need, in the field of market development, for centralized leadership and service. In the face of problems and difficulties which would have proved insuperable to men of ordinary courage, Mr. Freeman carried forward the work with unflagging zeal and confidence and, by his personal encouragement and guidance, made possible the more rapid and effective organization and development of local electrical leagues throughout the country and the establishment of other valuable services to electrical progress.

Despite discouragement, he held to the task until a year ago the critical financial condition of the society arrested the attention of the industry and compelled decision, whereupon with unabated confidence and enthusiasm Mr. Freeman seized the opportunity to make the problem officially an industry concern and, at a heavy cost of his personal time and energy, brought about a sweeping reorganization of the society directorate. By the appointment of the presidents and managing directors and other representatives of the four major national associations of the electrical industry and the League Council, he achieved a broad official co-ordination of all electrical interests, so that the directorate of the society now becomes practically a council of the industry.

In recognition of this distinguished contribution to the advancement of the spirit and practice of co-operation among electrical men, the judges have awarded to Mr. Freeman the medal and purse for co-operation for 1927, given under the James H. McGraw award.

Manufacturing Profits and Policies

Federal Trade Commission Dwells on These in the Second Part of Report on Electrical Industry—Holding Companies Weighed—N.E.L.A. "Lacking in Frankness"

LITTLE to support the demand for an investigation of the electrical industry is contained in part two of the Federal Trade Commission's report, which was sent to the Senate on Jan. 12. While the report points out that "the financial operations of holding companies escape state regulation" and mention is made of complaint that the state commissions must pass upon the allowance of items without having the authority to obtain information regarding their reasonableness, there is nothing in the report suggesting centralized supervision of the industry from Washington. It seems to be the idea of the Trade Commission that there might be federal legislation which would give the state commissions more latitude in obtaining information from companies chartered in another state. The Federal Trade Commission's summary of its report follows, with small omissions:

The General Electric Company has been for many years the largest manufacturer of power-plant machinery and equipment in the United States. Its value of sales billed increased from $16,000,000 in 1893 (the first complete year after its formation) to nearly $327,000,000 in 1926; its total investment increased from about $51,000,000 in 1893 to nearly $382,000,000 in 1926, and its net earnings were a little less than $3,000,000 in 1893 and (before deducting federal income taxes) over $59,000,000 in 1926.

As compared with the census classification of "electrical machinery, apparatus and supplies," which includes important products that are not used by the electric power industry, the value of the General Electric Company's output has represented from 16 to slightly more than 20 per cent of the total value for the country in recent census years. For the more important units of electric power equipment the General Electric Company's proportion is larger, representing for the census years 1919, 1921 and 1923 from 46.9 to 51.6 per cent of the value of all generators, from 52.2 to 58.3 per cent of the transformers, from 34.2 to 42 per cent of the motors, and from 32 to 45.1 per cent of the control apparatus. These percentages measure roughly the importance of the General Electric Company as a producer of the heavier lines of power equipment.

Prior to 1925 the three largest companies were the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Manufacturing Company. In 1925 the American Brown Boveri Electric Corporation, a domestic company manufacturing under American and foreign patents and technical information, was organized, thereby adding a fourth company to the group. The Brown Boveri company acquired several important firms manufacturing transformers, switches and electric railway equipment.

Manufacturing Profits

During the five-year period 1922-1926 the rate of profit of the General Electric Company, before deducting federal income taxes, ranged from 11.2 per cent to 16.2 per cent. Considering only the earnings on its investment in the electric manufacturing business (i.e., excluding outside investments), the rates of return during the same period ranged from 14.3 per cent to 22.8 per cent. The profits of other electrical companies were not obtained for this period, but for 1924 financial reports were received from 79 companies engaged to a greater or less extent in the manufacture of goods used by the electric power industry. The average rate of return for these companies, which had an aggregate total investment of about $490,000,000, was 9.6 per cent in 1924 as compared with 15.1 per cent for the General Electric Company, though some of these companies had higher rates of return than the General Electric Company.

The inquiry respecting competitive conditions in the manufacture and distribution of electric power equipment was limited to those lines, such as generators, transformers, motors, switches and switchgear, station equipment and line materials, that are essential to the production and distribution of electrical energy. Prior to 1925 the manufacture of such equipment was carried on partly by the three large companies mentioned above, generally known as "full-line" companies, manufacturing practically all kinds of power equipment, and partly by a large number of smaller "short-line" companies, confining their production in some cases to a single kind of equipment.

Large and Small Companies

The prices of these large companies are regarded in the trade as maximum levels above which the other comparatively small manufacturers generally cannot hope to sell. It is also the general belief among these comparatively small manufacturers that the large companies compete actively in price, quality and service. Some small manufacturers stated that although the large companies undoubtedly have the power to crush them by price competition, this power has not been used in recent years. It was stated, however, by certain small manufacturers of fractional-horsepower motors that in recent years prices have been reduced to levels at which they have been unable to compete. Many small manufacturers, on the other hand, stated that other small companies rather than the very large ones are their sharpest price competitors. The general opinion among the many small manufacturers called upon was that the General Electric and Westinghouse companies dominate the trade chiefly because of their financial resources, country-wide distribution and service organizations and their control of many of the largest wholesalers. The elements in the competition of the large companies that are most difficult for the small manufacturers to meet are the lump-sum bid, the quantity discount and the consignment of motors. There was some complaint of oppressive patent litigation, but no substantial evidence has been obtained on this point.

Preference for the equipment of one manufacturer over that of another because of previous installations plays an important part in the purchasing of some power interests, but in general power companies secure competitive bids and appear to purchase their equipment from the lowest bidder, other conditions as to the guaranteed efficiencies, times of delivery, etc., being satisfactory. Some large power groups distribute their purchases among different manufacturers for the specific purpose of maintaining competition.

Several manufacturers stated that prior to 1925 they were unable to sell to companies affiliated with the Electric Bond & Share Company, which was then controlled by the General Electric Company. Executives of the Electric Bond & Share Company stated that the company's policy had always been to purchase from the General Electric Company only in case the latter's prices and terms were at least as favorable as those of other companies. A study of the generators in use during 1925 in the plants of companies affiliated with the Electric Bond & Share Company, however, showed that for specified five-year periods within which such generators were installed from 1905 to 1925 91 to 97 per cent were of General Electric make, as compared with from 60 per cent to 75 per cent for other privately owned companies not so affiliated and from 36 to 44 per cent for municipal plants.

Patents and Research

The General Electric and Westinghouse companies, through their research organizations, have been leaders in developing patents, technical information and manufacturing experience in the nature of trade secrets that are of value to companies in foreign countries. Foreign companies likewise have patents and information valuable to companies in America. The result is that these two large American companies have severally entered into contracts with numerous large electrical manufacturing interests in the principal foreign industrial countries. By these contracts each party, among other things, makes the other its exclusive licensee under its patents in a specified territory. Thus these two large American companies have obtained the American rights under the foreign patents of many of the most important foreign companies. These rights may be used or withheld from use as the big companies see fit, as no other American manufacturer can obtain the rights without the consent of their American holders. Thus potential competition both of the foreign companies and of other American manufacturers who might otherwise obtain rights under the foreign patents is eliminated.

In the beginning of the electric power industry two or more independent plants frequently competed in supplying electrical energy in a given locality. This, however, resulted in comparatively small plants and in duplication of distribution lines, with resulting high costs for the energy sold by each of the competing companies. Consolidations of local companies followed, until at the present time each city or district usually is supplied by a single operating company. In most states these local monopolies are recognized by laws declaring them to be public utilities subject to governmental regulation. State regulation of sale of power is confined to intrastate commerce. The growing movement of power across state lines, with the development of large operating units and their connection to form larger so-called "superpower" systems, is steadily increasing the importance of interstate commerce in power, which is beyond the field of state regulation and for which there is at present no adequate provision for federal regulation.

Holding-Company Situation

Particularly during the last twenty years, numerous so-called holding companies have grown up which control, finance and man-

age local operating companies, sometimes situated in as many as twenty or more states. These holding companies normally own only voting stocks amounting in many cases to not more than 25 per cent of the total outstanding capitalization of operating companies. In many states the issuance of securities by operating companies and the expenditure of funds raised thereby is subjected to state regulation. The final transactions of a mere holding company, however, controlling operating companies in a given state but chartered in another state, escape direct regulation, because the holding company is not engaged in intrastate commerce in that state nor even doing business there. Consequently, the opportunity for unchecked speculative pyramiding of holding-company structures exists, and it has been exploited by the sale to the public of a large volume of holding-company securities that are based upon their equities, merely, in what has been aptly described as the "control of control" of operating properties. Not only do the financial operations of holding companies escape state regulation, but the fees charged for their services to operating companies likewise occasion difficulty to state regulatory agencies. Fees for financing and construction services are allowed to be capitalized as a basis for rates, while fees for operating management are chargeable to operating expenses. State commissions must pass upon the allowance of these items without adequate authority to obtain information regarding their reasonableness, if the holding companies are incorporated in other states. Some complaint on this score has been noted in particular instances.

Rate Regulation

Rate regulation was one of the earliest and still is the most important function of state regulatory bodies. The determination of the amount of investment to be used as a basis for measuring the fairness of rates is an important feature of rate regulation. The view of the Massachusetts and other state utility commissions as well as of the Interstate Commerce Commission that capital honestly and prudently invested should be taken as the controlling factor in the determination of fair and reasonable rates appears to be gaining ground. It is the frequent practice of holding companies, however, to group a number of local operating companies and merge them to form a single large operating company, with the possibility of profit to the holding interests in the turnover of the properties. Applications to state commissions for increased valuations following such mergers sometimes have been made and allowed.

The characteristic feature of the power industry under governmental regulation is the absence of competition in the usual sense of the word. Electric power, however, is in constant competition with other forms of power, particularly in the manufacturing industries. Electric power companies, therefore, frequently offer exceptionally low rates to induce industrial concerns to buy power rather than to produce it, and they also make sales to distributing companies at low rates. Such low rates, often made by special contract and with little or no effective supervision by regulatory agencies, may be for sales of power in interstate commerce, in which case state commissions do not have jurisdiction. Consumers of electrical energy for lighting, however, whose aggregate consumption represents not more than 25 to 30 per cent of the total demand but who pay 60 to 70 per cent of the gross amount derived from sales of energy, are dependent upon effective public regulation to insure that their rates are fair.

A notable feature of the power industry is the competition among holding-company interests to acquire desirable operating properties in various states. The frequent result of this competitive bidding, it is alleged, is speculative fluctuations in the prices of voting stocks of operating companies, for which prices paid often do not coincide with book equities nor bear any reasonable relationship to past or probable future earning capacities.

The Industry Associations

The power industry has a large and very active trade organization—the National Electric Light Association, which in 1926 included in its nine classes of membership 15,820 of the leading power operating and holding companies, manufacturers of electric power equipment, engineers, scientists and others interested in the development of the power industry. The object of the association, as set forth in its constitution, is to advance the art and science of the production, distribution and use of electrical energy largely through educational methods. The association's activities may be classed under three general heads: (1) Compilation and dissemination of technical and other information; (2) co-operation with other organized groups of manufacturers, dealers, engineers, scientists, financial interests, underwriters and with state and federal governmental agencies in the consideration of matters affecting the power industry, either directly or indirectly, and (3) educational activities intended to create public good will for the industry as at present conducted under private ownership subject to public regulation. Through its extensive divisional and committee organization, co-operation with technical, trade, financial, governmental and other organizations, and through its contacts with the press and other agencies for the molding of public opinion, the association undertakes many lines of activity that are unusual in trade association programs, and until quite recently, at least, it has sometimes been lacking in frankness toward the public.

There were formerly two manufacturers' trade associations and one manufacturers' social organization, federated under what was known as the Electrical Manufacturers' Council, which in 1927 were consolidated under the name of the National Electrical Manufacturers' Association. The council exercised an unusual amount of control over the activities of its constituent associations in applying the rule that all acts or proposed activities should be subject to review by the council's legal committee and its employed counsel. In this way the council was apparently alert in keeping the manufacturers' association activities in line with the requirements of the anti-trust laws.

Rate Cut to Save Cleveland Consumers $1,500,000

Announcement has been made by the Cleveland Electric Illuminating Company that a reduction amounting to approximately $1,500,000 will be made this year in the cost of electricity to residential and commercial consumers because of lower rates. The reduction was made possible by increased efficiency and economy in generation of electricity, according to company officials, and, in accordance with its policy, is passed on to the consumer. This is the third reduction announced by the company in the last four years.

The new rates as announced are 5 cents per kilowatt-hour for the first 80 kw.-hr., 4 cents for the next 420 kw.-hr. and 2.8 cents for all energy over 500 kw.-hr a month. The former rate was 5 cents for the first 500 kw.-hr. and 2.8 cents for more than 500 kw.-hr.

Boulder Dam Bill Is to Be Reported Favorably

Committee So Decides, Despite Vigorous Opposition from Arizona Men—Four of Secretary Work's Fact-Finding Advisers Report

A FAVORABLE report on the Swing-Johnson Boulder Dam bill will be made Jan. 14 by the committee on irrigation and reclamation of the House of Representatives. An announcement to this effect was made Jan. 10 by Representative Smith of Idaho, the chairman of the committee.

Mulford Winsor, president of the Arizona State Senate, appeared before the committee and urged that no legislation be enacted until an agreement can be reached by all of the states in the basin. It was declared that a similar view is held by Utah, Wyoming, Colorado and New Mexico. Representative Douglas of Arizona told the committee that the bill was unsound and summarized his reasons for that conclusion as follows: (1) Because by its very terms it implicitly provides for additional appropriations in excess of the $125,000,000; (2) by its very terms construction work and expenditures of money cannot be begun before firm and binding contracts for the sale of electrical energy are in hand; (3) because, even though contracts in hand be necessary and essential under the terms of the act before construction work could be begun or expenditures made, it will be impossible to obtain such contracts; (4) because the federal government can never be reimbursed for its expenditures, even assuming that it could obtain contracts; (5) in the absence of an agreement with Mexico, or pronouncement placing Mexico on notice, the construction of a dam at Boulder Canyon under the terms of the Swing-Johnson bill will provide a regulated flow of water which can and will be so applied to beneficial use in Mexico that the southwestern part of the United States will be seriously affected in its agricultural development throughout its entire future.

H. S. McClusky, a member of the Arizona Commission for the Colorado River, told the committee that in considering charges that the "Power Trust" is financing the opposition to the Swing-Johnson bill attention should be given the fact that "a pernicious lobby is lined up in support of the measure." He said further that a former governor of Pennsylvania and the Hearst organization are connected with this lobby.

Secretary Work of the Interior Department wrote to Chairman Smith indorsing the bill, and the committee had also before it four reports from as many

advisers named in April by Secretary Work to consider the project from every angle. Senator Waterman of Colorado, a fifth adviser, has not yet reported.

The advisers, including James R. Garfield, former Secretary of the Interior; Governor Emerson of Wyoming, former Governor Scrugham of Nevada and Professor William F. Durand of Stanford University, reported individually on questions asked by the Secretary as to the feasibility of the project and whether or not the government could and should proceed without unanimous approval of the Colorado River Basin states.

Indorsement of the project is contained in the Garfield report, which also urges its immediate construction, primarily because of flood menace to the Imperial Valley. It holds that the federal government has the right to proceed.

The Scrugham report, while urging immediate action, deals largely with the power to be developed, and suggests a plan for allotment of power which Mr. Scrugham believes would be approved by Arizona, Nevada and private power interests.

While recognizing the need for flood protection, Governor Emerson insists that the Colorado River compact should be ratified by all seven states before the proposed legislation is enacted.

Engineering features stand out in the Durand report, which emphasizes the flood danger and declares that the All-American Canal, which its proponents hold would relieve the Imperial Valley from dependence upon Mexico for water, is not only an urgent need, but that it could be constructed for considerably less than the government's estimate of $31,000,000.

The Chamber of Commerce of the United States has adopted resolutions directed against government ownership at Boulder Dam.

"The New Competition" to Come Before N.E.M.A.

Charles F. Abbott, executive director of the American Institute of Steel Construction, will address the general meeting of the Supply Division of the National Electrical Manufacturers' Association on the afternoon of Tuesday, Jan. 24, on "The Third Industrial Revolution," giving experiences of the steel industry which may help the electrical industry to meet its own problems. H. T. Bussmann of the Bussmann Manufacturing Company will follow Mr. Abbott with an account of what the sales conference has accomplished and will also present a program of action for the Supply Division.

The grounding and distribution sections of the National Electrical Code will provide important topics at the convention, which will extend from Monday to Friday, and there will be full discussions on the development of markets. Study of "the new competition" will also form part of the proceedings.

A dinner meeting of section chairmen of the Supply Division, with D. Hayes Murphy presiding, will be held at 7:00 p.m. at the Hotel Commodore on Jan. 23. Gerard Swope, president of the N.E.M.A., and members of the board of governors will attend.

Wired Radio, Inc., Applies for Wave Bands

Wired Radio, Inc., has applied to the Federal Radio Commission for permission to use short waves for broadcasting radio programs over light and power wires. The commission will take no action until after the hearing on short-wave allocations on Jan. 17. The request was for permission to use three frequencies in the band commencing with 1,500 kilocycles.

The North American Company bought the plans of General George O. Squier several years ago and through its subsidiary, Wired Radio, Inc., has been developing the system for several years. The latest technical development permits of a single receiving set with three switches for use in the reception of any of three programs sent over central-station three-phase systems. As visualized in future development, programs will be made at a central location and will be transmitted by wire to the ultimate user. If the plan becomes popular, it may be that the way will be opened for charges to users of the equipment.

The application placed before the commission indicates the ripening of the wired-radio plan, and it is reported that several electrical groups are concerned in starting it on its career. The utilities are much interested because the sets will use considerable energy.

Floodlighting the Quaker City Edison Building

AN UNUSUALLY fine example of floodlighting was given at Philadelphia on New Year's Eve, as described last week (ELECTRICAL WORLD, page 70) when the Philadelphia Electric Company's new 23-story office building at Ninth and Sansom Streets was illuminated for the first time with moving light of many hues, said to be the only permanent installation of that kind yet made. In the installation 483 floodlamps are used, rated at from 500 cp. to 1,000 cp.

The installation was designed by Arthur A. Brainerd, assistant illuminating engineer of the company. He was the winner of a McGraw prize at the last N.E.L.A. convention. The Pittsburgh Reflector Company supplied 467 of the floodlamps three weeks after they were ordered. Two 18-in. floodlamps were supplied by the General Electric Company, fourteen prismatic inclosing units were furnished by the Holophane Glass Company, while the color caps and lenses were supplied by the Laco-Phillips Company. The electrical work was installed by the J. F. Buchanan Company of Philadelphia. The total load is 262 kw.

Herminghaus Suit Ended

Southern California Edison Company Acquires 17,500 Acres of Riparian Land Along the San Joaquin for Sum Put at $1,000,000

BY A SETTLEMENT out of court of the suit brought against it by the Herminghaus estate, the progress of which has been followed in these columns, the Southern California Edison Company has acquired title to 17,500 acres of land bordering the San Joaquin River in Fresno and Madera Counties. The consideration was reported to be $1,000,000.

The property involves riparian rights to water in the San Joaquin River which the power corporation was restrained from impounding in its Florence Lake hydro-electric reservoir in the Sierras east of Fresno. Litigation over the Southern California Edison Company's condemnation suit against Mrs. Amelia Herminghaus and other heirs of the Herminghaus estate to obtain these rights had lasted three years.

Governor Fuller Backs Massachusetts Commission

In his address to the Massachusetts Legislature at its opening session on Jan. 4, Governor Alvan T. Fuller came squarely to the support of the Department of Public Utilities in its resistance to all efforts to substitute for the department's present method of rate valuation one based on reproduction cost new less depreciation and indorsed the department's recommendations as outlined in the ELECTRICAL WORLD for Dec. 17 (page 1265), declaring the time to be ripe for the enactment of such legislation.

Sales Conference Developing Industry Program

The Industry Sales Conference, composed of delegations representing the four major national associations and the League Council, held its second meeting on Wednesday in the board room of the National Electrical Manufacturers' Association, New York, to consider the recommendations of the committee that had been appointed to study the problems presented by the present inadequacy of house wiring.

The plans of the conference are taking the direction of a broad program that will combine a national movement of locally organized selling campaigns to merchandise the idea of adequacy in house wiring, these campaigns to enlist the co-operation of all local interests, the central-station companies assuming the responsibility for leadership, and utilizing the services of the leagues. This will entail national direction and regional field service and a consistent continuing program looking forward over a term of years, with highly organized selling of convenience outlets as its first major objective.

To carry forward such a movement will require the co-operation and support of the contracting industry. The conference is developing the possibilities of organizing a broad educational work among all contractors, to promote better standards of estimating, cost keeping and business methods similar to the work that has been so successfully done in the plumbing industry. In effect this would provide an expansion of the very effective service that the Association of Electragists has been performing for its members, but to embrace the entire personnel of the contracting industry, now working for the most part uninfluenced by any association. This subject is being well studied and programmed.

At the same time, careful consideration is being given to the needs for adopting the merchandising policies of the industry to such a movement, so that the installation of additional outlets in the home may be capitalized by the immediate sale of appliances. The reports of these functional committees were analyzed and finally referred to the executive committee of the conference as the basis for the full report and recommendations which will be presented this spring to the four national associations, now acting as a council of the industry in the directorate of the Society for Electrical Development.

A New Year's Epitome of "Electrical World" History

The *Electrical World* (published under that name since 1883 and tracing its history back to 1874) is a consolidation of the *Electrical Engineer* (founded in 1882 as the *Electrician*) and the *American Electrician* (founded in 1896). Final consolidation under the title of *Electrical World* took effect on Jan. 1, 1906, the *Electrical World* and the *Electrical Engineer* having been acquired by the McGraw Publishing Company in 1899 and amalgamated as the *Electrical World and Engineer*, and the *American Electrician*, a McGraw monthly, having been absorbed seven years later.

The roster of past editors of the *Electrical World* includes Carl Hering, Louis Bell, W. D. Weaver, T. C. Martin and many other men prominent in the electrical industry—some, like those named, no longer living, and others, like C. O. Mailloux, A. S. McAllister, Frank F. Fowle, F. M. Feiker, D. H. Braymer and H. V. Bozell, still active in engineering and industrial service. William H. Onken, Jr., is now editor and L. W. W. Morrow managing editor. Other members of the present staff are: Earl Whitehorne, commercial editor; Allen M. Perry, associate editor; G. F. Wittig, statistical editor; H. M. Cameron, financial editor; F. C. Wells, news editor; Eustace C. Soares, manufacturing and markets editor; E. R. Searles and E. M. Glennon, assistant editors; F. R. Innes and T. P. Kindig, Western editors; H. S. Knowlton, New England editor; Walter C. Heston, Pacific Coast editor, and Paul Wooton, Washington correspondent.

Ontario Hydro Defeated at "the Soo"

Voters of Sault Ste. Marie, Ontario, Accept Plans of Great Lakes Power Company in Preference to Those of Provincial System

THE Ontario Hydro-Electric Power Commission lost its fight for the development of power at Sault Ste. Marie, Ontario, in the municipal elections in that city on Jan. 2, when a majority of the voters accepted the Great Lakes Power Company's proposal to supply the power needs of the community. (See ELECTRICAL WORLD for Dec. 10, page 1219). One feature which entered into the contest in its closing hours was an announcement by the Algoma Steel Corporation that a win for the Hydro would destroy the labor of five years in negotiations for an extension of its industries entailing an expenditure of $12,000,000. The steel plant has arranged for power at a definite price, and it insisted that a victory for the Hydro would put the whole power question "up in the air."

The Algoma Power Company, which, like the Great Lakes Power Company, is a subsidiary of the Middle West Utilities Company of Chicago, will begin surveys at once on the Montreal River, 90 miles from "the Soo," where it is held that 25,000 hp. can be developed and transmitted.

A.E.C. Steadfast Against Federal Ownership

Meeting in Washington from Monday to Wednesday inclusive of this week, the American Engineering Council went on record in opposition to the expenditure of federal funds for the Boulder Dam project, on the ground that it involves federal ownership and sale of power. The council therefore voted its disapproval of the Swing-Johnson bill. The bill of Senator McKellar to establish a Muscle Shoals commission was likewise disapproved by the meeting.

That the American Engineering Council is opposed to the principle of federal subsidy was also made clear in a discussion of the Tillman bill, which would advance government funds for the development of agriculture, home economics and industry. While agreeing unanimously that the engineering profession should support a sound federal program to assist agriculture, it was maintained that this form of assistance does not coincide with the engineering point of view.

Action of the council on legislative measures followed the recommendations of its public affairs committee, headed by A. W. Berresford of New York. Mr. Berresford, a notice of whom appears under "Men of the Industry," was elected to succeed Dean Kimball of Cornell University as head of the A.E.C. Sir Esme Howard, Ambassador from Great Britain to the United States, was the speaker at the banquet on Tuesday evening.

"Electrical World's" London Letter

Underground Cables Urged by Heterodox Engineer for England's Proposed Interconnected Network—Standardization, Lighting, New Installations, Commercial Progress, "Personals"

By Bernard C. Holding
Editor of "The Electrician"

London, Jan. 1, 1928.

ELECTRICALLY speaking, the last months of 1927 over here were full of items of interest, though it is difficult to point to any one of these as being of outstanding importance.

One interesting feature has been the reading of the inaugural addresses of the chairmen of the various sections of the Institution of Electrical Engineers. In these addresses many unorthodox viewpoints have become apparent, one of the sectional chairmen actually having the temerity to urge the merits of underground cables, as against overhead lines, for the extensive interconnected supply network that is proposed for this country. Committed, as we seem to be, to the overhead method, this voice cannot be regarded otherwise than one crying from the wilderness, even though the arguments adduced in favor of the underground method seem to have some merit.

Great activity is noticeable in the issue of British Standard Specifications for various types of electrical equipment. During November a revised specification was issued for bayonet lamp holders, the dimensions of which will now conform to the international standard laid down by the International Electrotechnical Commission in so far as interchangeability is concerned. Another new standard established is for reversible protected-type two-pin plugs and sockets with earthing connections.

Interest in Lighting

As we have heard from one of our illuminating engineers who studied lighting conditions in such places as New York, Chicago, Detroit, Cleveland, Schenectady, Boston and Philadelphia, great attention is being paid to lighting service in your country. Similar interest is being aroused over here by the various lighting service bureaus which have been established in some of the large towns. The London bureau has recently been rearranged on new lines which permit the reproduction of both good and bad lighting in actual home, shop, school and factory surroundings. Great success is also attending the giving of lectures on home lighting to large audiences of housewives, schoolteachers, tradesmen and others.

In the field of public lighting it is becoming increasingly apparent that the whole of the lighting of thoroughfares in this country should be placed under the supervision of one central advisory body. With the continued growth of motor traffic, the part which suitable public lighting can play in accident prevention assumes ever-increasing importance, and this factor alone is sufficient reason for tackling public lighting problems on national lines.

On the electricity supply side of the industry, November has seen the inauguration of power-station extensions at the municipal undertakings of St. Pancras and Stoke-on-Trent, the former comprising a further 10,000/12,500-kw. Brush-Ljungström generating set. This station was the first in England to install plant of this type, having started up a 1,500-kw. set by the same makers in 1914. During the month one of the London company undertakings—the Charing Cross Electricity Supply Company, Ltd.—started up a new General Electric-Fraser & Chalmers oil-engine set comprising a 1,750-b.-hp. six-cylinder oil engine coupled to a 1,200-kw. direct-current generator. This is believed to be the largest stationary set of its kind yet built in Great Britain.

On the commercial development side of the supply industry elaborate electricity showrooms have been opened by the Battersea (London) Borough Council and by the Westminster Electric Supply Corporation, Ltd., which has announced a new tariff reducing the cost of energy for cooking and for "off-peak" water heating to the very low figure of ½d. per kilowatt-hour.

Other matters of interest during recent weeks included the unveiling of a memorial tablet to Michael Faraday in his native borough of Southwark, where the nucleus of a Faraday Memorial Collection of the best books on electricity and allied sciences has been formed; the Commercial Motor Exhibition, where six-wheeled electric trackless trolley buses, with double-deck, covered-top bodies, were seen, and the change-over to automatic working of a busy London telephone exchange.

Of personal interest is the appointment of Lieut.-Col. W. A. Vignoles, borough electrical engineer of Grimsby and a past-president of the Incorporated Municipal Electrical Association, as director and secretary of the British Electrical Development Association in the place of J. W. Beauchamp, who is retiring at the end of the year to become chief engineer of the South Wales Power Company. It may also be of interest to record that at the next general election Prime Minister Baldwin is to have as a Labor party opponent H. M. Gibson, a clerk in the Manchester Electricity Department.

Mr. Insull Supplements His Reed Committee Testimony

The investigating committee which held hearings a year ago, under the chairmanship of Senator Reed of Missouri, to inquire into alleged irregularities in the 1926 senatorial elections in Pennsylvania and Illinois, resumed its sittings last week. This inquiry is of special interest to the electrical industry because it brought from Samuel Insull, president of the Commonwealth Edison Company, an admission that he had contributed very large sums to political campaigns, including that of Frank L. Smith, former chairman of the Illinois Commerce Commission, for United States Senator.

It may be remembered that Mr. Insull and his attorney, Daniel J. Schuyler, refused to disclose to whom $40,000 of the utility head's total contributions of $237,925 went on the ground that to do so would be a betrayal of confidence. Contempt proceedings were thereupon threatened by the committee. Last week, feeling released from the obligation of secrecy, Mr. Insull and Mr. Schuyler testified that half of the $40,000 went to Charles F. Francis, of the Small-Lundin faction in Cook County politics, and half to George F. Harding of the "Big Bill" Thompson group. Mr. Insull testified that he frequently borrowed various sums for campaign contributions from the Commonwealth Edison Company, placing an "I. O. U." in the drawer and eventually repaying the sums by check.

When Mr. Schuyler was on the witness stand Senator Reed sought to obtain admissions that in his view Mr. Insull contributed to campaign funds because his utility companies were involved in political controversy. Mr. Schuyler said that if he were in Mr. Insull's position with vast interests to protect he would desire to maintain friendly relations with public officials.

Commission Asks for Data on Political Expenditures

Cognizance of public agitation concerning contributions by utility companies or their officials to political campaigns has been taken by the California Railroad Commission, which on Jan. 3 adopted the following resolution, addressed to the various utilities under its jurisdiction:

Resolved, That by order of the Railroad Commission you are required to supplement your 1927 annual report with a statement showing the amount of money, if any, expended by you for political purposes, the accounts to which such expenditures were charged and the purposes for which such expenditures were incurred or made.

By "expenditures for political purposes" is meant such expenditures, including allocations of compensation of executives, officers and employees for time devoted to political purposes, as are incurred or made to elect or defeat a candidate for public office, or to support or defeat any measure on the ballot, or to place any measure on the ballot, or to keep it from being placed on the ballot at any state, county, municipal or other election during the year.

Such statement shall be submitted by the president or general manager of the company under oath, which oath shall show that he knows the facts contained in the statement to be true and correct of his own knowledge. Such affidavit should also show that no expenses for political purposes have been incurred which are not included in the statement.

Purchases and Mergers

Niagara, Lockport & Ontario Company Starts Operation as New Consolidation—Central Maine Power Company Authorized to Buy Four Others

IDENTITIES of the former Niagara, Lockport & Ontario Power Company and the Western New York Utilities Company were merged on Jan. 1 in the new Niagara, Lockport & Ontario Power Company, with headquarters in Batavia, N. Y. The Western New York Utilities Company became one of the Buffalo, Niagara & Eastern group last spring, and petition for its consolidation with the Niagara, Lockport & Ontario was filed in the fall. It had had its headquarters in Batavia and branch offices in Albion, Medina and Brockport. The old Niagara, Lockport & Ontario Power Company had headquarters in Buffalo.

Authority has been given to the Central Maine Power Company by the Public Utilities Commission of Maine to issue bonds and stock for the purchase of the Western Maine Power Company for $1,057,437, the Fryeburg Electric Light Company for $27,301, the Bethel Light Company for $36,403 and the Black Stream Electric Company for $51,000. These purchases total $1,172,-141 and other moneys will be expended for betterments.

The Harlem Valley Electric Corporation, Chatham, N. Y., has filed a certificate in the office of the Secretary of State merging with it the Chatham Electric Light, Heat & Power Company. The Public Service Commission has approved the transfer by Harlan E. Ralph of an electric distributing system in Belleville, Ellisburg and Henderson, Jefferson County, to the Woodville (N. Y.) Electric Light & Power Company for $8,000.

The Mohawk-Hudson Power Corporations has received permission from the New York Public Service Commission to acquire the stock of the Schodack Light & Power Corporation, which supplies electricity in Castleton and immediate vicinity. The Schodack company has been buying its electricity. The New York Power & Light Company has made application to the Public Service Commission for permission to merge with it the Blue Hill Light & Power Company of Livingston, Columbia County.

It is planned to sell the rights and lines on Indian River, in the southwest portion of St. Lawrence County, N. Y., owned by the Rossie Electric Company, to the Oswegatchie Light & Power Company. The Rossie company's rights are in the main undeveloped.

The City Council of Hooker, Okla., has sold the municipal light and power plant to the Inland Utilities Company of Kansas City for $30,000, subject to approval of the voters. Citizens of Locust Grove, Okla., have voted to sell their distribution system and municipally owned transmission line to the Public Service Company of Oklahoma, to which a franchise has been granted.

Purchase of the electric light and power plant at West Fork, Ark., has been announced by the Southwest Power Company. The purchase price was not made public.

The Carolina Power & Light Company, Raleigh, N. C., has taken over the South Carolina Power & Light Company, with headquarters at Kingstree, S. C., serving the interconnected towns of Kingstree, Manning, Lake City, Andrews, Lanes, Greeleyville and Scranton.

The village of Sargent, Neb., has called a special election for Jan. 24 to pass on the question of selling the municipal plant to the Nebraska Electric Power Company for $17,500.

The Indiana Public Service Commission has authorized the purchase by the Interstate Public Service Company of the Holton Electric & Power Company for $15,400.

Acquisition by the Washington Water Power Company, Spokane, of the plant and system of the Calispel Light & Power Company on Jan. 1 added the towns of Dalkena, Usk and Cusick, Wash., to the first-named system. The company recently purchased also the Lacrosse (Wash.) Electric Company and the Greenacres Power & Light Company, as well as the Potlach Consolidated Company in Idaho, these systems having distribution systems only.

Prentiss, Miss., has received bids from power companies for the sale of its municipal plant and is considering them.

The Alma (Ga.) lighting plant has been taken over by the Southeast Georgia Power Company.

Control of the Union Power Company's plant at Drumhellar, Alberta, Canada, has been acquired by the International Utilities Corporation, and it is the intention of the new owners to make Drumhellar the center of distribution for electric power over a wide area where coal mines abound.

Attack Authority of Tennessee Commission Over Streams

Charging that the Railroad and Public Utilities Commission of Tennessee has no authority in law for the powers it attempts to exercise in control and regulation of water-power development upon the streams of the state, suit has just been filed in the Nashville Chancery Court by the Tennessee Eastern Electric Company against the commission, praying the court to construe the legal powers of the commission, and likewise to declare the rights of the owners of water-power sites. Pending the determination of these issues, the court is asked to enjoin the commission from granting any permit on a designated power site on the Holston River which the petitioning company has planned to develop.

Because of the rapid growth of its territory, says the petition, the company began several years ago to acquire title to lands along the Holston River for the purpose of building a large hydro-electric plant, and it has now expended about $500,000 for this purpose and acquired 2,500 acres of land for a dam site. Assumption last fall by the commission of authority over state water power, the company asserts, prevented further progress on the development and confused in the minds of the public the entire question of the right on the part of the owner of riparian rights to proceed with the development of water power of any character, and particularly where such development pertains to non-navigable streams. Determination of this case may have a marked effect upon the development of the water-power resources of Tennessee and perhaps of other states.

Briefer News

THIRTY-NINE MILLIONS TO BE SPENT BY MICHIGAN ELECTRIC UTILITIES THIS YEAR.—Michigan electric utility companies will spend about $39,000,000 in the coming year in extending and improving service, according to the Public Utility Information Bureau of that state. The added facilities will make it possible to take on 50,000 more customers. Farm service is to be pushed.

WATER-POWER PROJECT FOR TRINITY COUNTY, CAL.—Preliminary plans for a power plant on streams in Trinity County, Cal., have been filed at Sacramento with an application for water rights from George E. Waggoner, Stockton, and Robert L. Little, Los Angeles. The applicants seek to divert 100 cu.in. from Stony and Deer Creeks and Stuart's Fork, producing approximately 20,000 hp. The water will be used to supplement other grants for the plant, which is to be situated near Weaverville. An eventual outlay of $5,000,000 is said to be entailed.

LIGHTING COURSE FOR CONTRACTORS.—A course in illumination for electrical contractors will be launched on Jan. 17 under the auspices of the lighting committee of the Metropolitan New York Section of the National Electric Light Association. The course will consist of five lectures, each complete with demonstrations, to be given at 8 p.m. on Tuesday evenings for five weeks in the Electric Building in Long Island City. Later, similar courses will be given in the other boroughs of the city. On Jan. 1 the registration for the course was 65, and it is expected the total enrollment will exceed 75. Lecturers will represent the Edison Lamp Works, Harrison, N. J.; the Westinghouse Lamp Company, Bloomfield, N. J.; the Graybar Electric Company, the United Electric Light & Power Company and the New York Edison Company.

RAILROAD ELECTRIFICATION TO BE A TOPIC AT MICHIGAN ENGINEERING CONFERENCE.—"The Electrification of Steam Railroads in the United States" will be discussed by W. M. Vandersluis, electrical engineer Illinois Central Railroad, at the afternoon session of the Michigan Engineering Conference at the Hotel Statler, Detroit, on Friday, Jan. 27, over which Alex Dow will preside and which will be addressed also by John Lyle Harrington on "The Part of the Engineer in Enterprises Based on Engineering." A. L. Powell will speak on "Science with Art in Lighting" at the evening banquet, over which H. H. Higbie, past-president Illuminating Engineering Society, will preside. The talk by Mr. Powell, who is the manager of the engineering department of the Edison Lamp Works at Harrison, N. J., will be illustrated. On Saturday Prof. Comfort A. Adams will speak on welding, C. F. Hirshfeld of the Detroit Edi-

son Company on "Two Blades Where But One Grew Before," and Prof. George L. Clark of the University of Illinois on "X-Rays as an Engineering Tool."

CONOWINGO CONDEMNATION RIGHTS UPHELD. — By declining to hear argument for the defense the United States Supreme Court last week indicated that it would dismiss the appeal of James C. Colgate from the decision of the Pennsylvania courts, already noted in these columns, upholding the right of the Philadelphia Electric Company to condemn land in Pennsylvania for a transmission right-of-way from its Conowingo development. The plaintiff held such condemnation to be illegal because the power plant itself was in another state.

FLATHEAD LAKE AGREEMENT AT POWER COMMISSION HEARING.—Agreement to raise the level of Flathead Lake to 2,893 ft., an altitude said to be satisfactory both to local residents and to promoters of the Columbia Basin project, was reached at a Federal Power Commission hearing held by Major John Butler in Polson, Mont., and continued in Kalispell, Mont., late in December. Application of the Rocky Mountain Power Company for a large development at the foot of the lake is expected to be granted on the filing of an amended application reducing the altitude from 2,902 ft.

LOWER RATES IN SOUTH GEORGIA SOUGHT BY STATE COMMISSION.—The Georgia Public Service Commission has required the Georgia Power & Light Company, operating in a number of south Georgia cities, to show cause why it should not reduce both light and power rates in all of the communities that it serves. The company, which is a subsidiary of the National Public Service Company, a former Fitkin property, now under Insull control, obtains part of its power from Florida, and it is the opinion of the commission, according to Chairman James A. Perry, that this fact ought to enable the company to reduce its charges. Cities and towns affected by the order include Bainbridge and Waycross.

HOUSTON LIGHTING & POWER BUDGET. —A sum of $6,242,804 is to be spent on improvements during 1928 by the Houston Lighting & Power Company. This figure is approximately $500,000 in excess of the amount expended on improvements by the company during 1927. The program will bring the lighting and power facilities of Houston to a standard considerably above the present demands of the city, officials of the company say. The improvement program calls for expenditures as follows: New substations and improvements to existing substations, $363,841; substation and transmission transformers, $127,000; communication, $98,000; improvements of distribution system, $352,779; improvements of transmission system, $195,089; improvements of substation feeders, $401,000; improvements of power stations, $254,845; new turbines for Deepwater plant on the Houston Ship Channel, $3,000,000; improvements and extensions to underground system, $255,000; stores and shop buildings, $406,500; new meters, $140,000; new transformers, $140,000; short line extensions, $200,000; street-lighting equipment, $75,000; miscellaneous improvements, $233,750.

RECEIVERSHIP SOUGHT BY SPARTANBURG COMPANY AS STEP TO READJUSTMENT.—The South Carolina Gas & Electric Company of Spartanburg, S. C., which was bought last fall by the Southern Public Utilities Company of Charlotte, N. C., controlled by the Duke Power interests, is defendant in an action instituted in the United States District Court by the Merchants & Farmers' Bank of Spartanburg as trustee asking appointment of a receiver. The action is taken as a new step in the direction of a financing plan to prevent the company from being operated at a loss of $100,000 per annum, owing in large measure to interest charges fixed by outstanding bonds and other forms of indebtedness. It is expected that the Southern Public Utilities Company will find in the action brought by the bank an opportunity to have the whole problem involving Spartanburg's utilities adjusted on terms that will allow them to go forward with a progressive program.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see Electrical World for January 7, page 80.]

Electrical League Conference — 30 North Dearborn Street, Chicago, Jan. 16 and 17. Society of Electrical Development, 420 Lexington Avenue, New York.

New England Electrical Credit Association—Boston, Jan. 17. C. A. Kane, 176 Federal St., Boston.

N.E.L.A. Commercial Section—Edgewater Beach Hotel, Chicago, Jan. 18-20. A. J. Marshall, 420 Lexington Avenue, New York.

National Electrical Manufacturers' Association — Supply Division, Hotel Commodore, New York, Jan. 23-27. S. N. Clarkson, 420 Lexington Ave., New York.

New England Central Station Association of Power Engineers—Chamber of Commerce, Boston, Jan. 25. T. D. Bond, C. H. Tenney & Co., Boston.

Artistic Lighting Equipment Association—Winton Hotel, Cleveland, Jan. 25-28. G. P. Rogers, 711 Graybar Bldg., New York.

Northwest Association of Electrical Inspectors—Olympic Hotel, Seattle, Jan. 26-28. F. D. Weber, 414 Lumbermen's Building, Portland, Ore.

Iowa Section, N.E.L.A.—Roosevelt Hotel, Cedar Rapids, Feb. 2 and 3. H. E. Weeks, Davenport, Iowa.

American Institute of Electrical Engineers — Winter convention, New York, Feb. 13-16. F. L. Hutchinson, 33 West 39th St., New York.

Rocky Mountain Division, N.E.L.A.—Albuquerque, N. M., Feb. 14-16. O. A. Weller, 900 15th St., Denver.

Midwest Power Conference — Hotel Stevens, Chicago, Feb. 14-17. G. E. Pfisterer, 53 West Jackson Blvd., Chicago.

Iowa Power Conference—University of Iowa, Iowa City, Feb. 15 and 16. Joe Carmichael, Iowa Committee on Public Utility Information, 310 Crocker Bldg., Des Moines.

Northwest Electric Light and Power Association — Commercial Section, Portland, Ore., Feb. 20 and 21. J. C. Plankington, Northwestern Electric Company, Portland, Ore.

HIGH VOLTAGE FOR NEW WILMINGTON-ATLANTIC CITY LINE.—According to C. H. Howell, general manager Atlantic City Electric Company, plans for the steam-electric plant to be built on the Delaware River opposite Wilmington, Del., jointly by the American Gas & Electric Company and the American Electric Power Corporation, as reported in the ELECTRICAL WORLD for Dec. 17 (page 1263), include a 232-kv. transmission line to be built from Churchtown, near Pennsville, N. J., the site of the plant, on Deepwater Canal, to Atlantic City. The plant, which is eventually to have a capacity of 400,000 kw. and may cost $13,000,000, will serve parts of Atlantic, Cape May, Ocean, Cumberland, Gloucester and Salem Counties in New Jersey as well as the territory of the Delaware Electric Power Company. Cost of the transmission line is put at $1,000,000.

INTERNATIONAL AGREEMENT ON DEVELOPMENT OF KOOTENAI EXPECTED IN YEAR.—Delay of one year at the request of Secretary of State Kellogg, during which time a satisfactory plan for reclamation and power uses of the Kootenai River is expected to be reached, was announced at a hearing in Nelson, British Columbia, held late in December, at which the Canadian and American governments and private interests were represented. Flood protection for northern Idaho farmers, a reclamation project at Creston, just over the intenational line, and a reservoir and dam to develop 35,000 hp. for the West Kootenai Power & Light Company is in prospect. Three former United States senators, sitting as American members of the joint commission on boundary waters, asserted that they were satisfied a conspicuous example of co-operation between nations and for both agricultural and power development would result from the long-litigated situation on the Kootenai River and lake.

NOTES FROM OHIO.—The Defiance City Council has passed an ordinance for the erection of a municipal lighting plant to cost $405,000. Defiance is served by the Toledo Edison Company. ——The Dayton Power & Light Company, which is building a second line to Washington Court House from its Dayton plant, has about half of the poles set and will dismantle, move and reassemble 190 steel towers now in use along the Bowersville Road. The line will not be completed until July.——A second reduction in rates within a period of two months for electrical energy furnished by the Wooster Electric Company is announced. The company's first cut was voluntary. The new one

was perhaps hastened by an application for a 25-year franchise made by the Western Reserve Power & Light Company. Company officials say it would have been made a little later on in any event.

ARKANSAS POWER & LIGHT BEGINS 110-KV., 47-MILE TRANSMISSION LINE.—The Arkansas Power & Light Company began on Jan. 3 to build the 110-kv. power line that is to extend from the Woodward substation at Pine Bluff to the Dixie substation in North Little Rock, a distance of 47 miles. At the same time the work of enlarging the Woodward and Dixie substations was started. At North Little Rock several transformers will be installed, and the Woodward station will be rebuilt of steel. It is hoped to have the work completed by March 15. This is the first of several expansion projects to be undertaken by the company in Arkansas this year.

BRITISH COLUMBIA UTILITY COMPANY REDUCES RATES.—For the sixth time since 1917 domestic lighting rates will be reduced by the British Columbia Electric Railway Company in Vancouver on January 1. The new rates will be 4 cents a kilowatt-hour on the first step and 2 cents on the second. Corresponding reductions will be made in suburban areas and in commercial rates. In the city of Victoria rates will go down from 7 cents to 6 cents a kilowatt-hour, with the abolition of the meter charge but the inauguration of a minimum charge of $1 a month. The reductions are estimated to mean a saving to the public of $325,000 a year.

NEW ENGLAND POWER COMPANY CONSTRUCTION.—The largest single item in construction expenditures listed by the New England Power Company with the Massachusetts Department of Public Utilities is that of transmission lines, on which the company between Aug. 1, 1926, and Oct. 31, 1927, expended $894,520. To bring the new transmission-line construction to completion another $113,480 will be required. The next largest item is for transforming and switching stations, for which the ultimate cost is figured at $618,756, of which $590,734 has been expended. The company has under way a 110,000-volt steel-tower line between Bellows Falls, Vt., and Pratt Junction, Mass., cost of which is estimated at $650,000, and another line of similar voltage between Ayer and Tewksbury, Mass., which is expected to cost $344,430, besides a substation to cost about $475,800 under way at Pratt's Junction.

DOWNTOWN INDIANAPOLIS TO HAVE ALTERNATING CURRENT.—Installation of an alternating-current system for the downtown business district of Indianapolis will be the principal improvement undertaken by the Indianapolis Power & Light Company this year, according to President Norman A. Perry. Company officials will also direct their attention to the further consolidation of distribution lines throughout the city, a work that has been in progress since early in 1927. The new downtown system will be installed gradually and the buildings of the future will be supplied from it. A substation will be built in the southeastern part of Indianapolis and one of the company's existing downtown substations will be moved to a better location. The company is changing over its fleet of trucks to electric vehicles since this form of transportation is proving economical for a large percentage of truck work.

EXPANSION OF OKLAHOMA GAS & ELECTRIC'S HORSESHOE LAKE STATION.—The equipment which is now being added to the electric generating station of the Oklahoma Gas & Electric Company at Harrah will give a capacity of 87,500 hp. A 40,000-hp. turbo-generator is being added with two boilers which will burn powdered fuel. A heavy transmission line has been completed between the Horseshoe Lake station and the Riverbank station at Muskogee, the final link between Sapulpa and Drumright being now ready. The company also announces that interchange of power with the Public Service Company of Oklahoma is made possible by a line recently finished between the Seminole oil field and the Public Service lines west of Weleetka. The company is constructing a short 13,000-volt transmission line to connect its system with a 5,000-kw. steam plant being built 3 miles west of Howe by David Reed of Fort Smith, Ark., partly to furnish power to coal mines in the vicinity.

Commission Rulings

CONSUMPTION CHARGES FOR ELECTRIC REFRIGERATOR.—The Illinois Commerce Commission has sustained the complaint of a consumer against the rates of the Illinois Northern Utilities Company for energy supplied to a refrigerator. The complainant contended that it was inequitable to attach a motor-driven device to the light circuit and that it should be attached to a heating circuit, since, the contention went on, the mechanical refrigerator is more nearly an off-peak consumer than ordinary domestic heating and cooking devices. The commission, in ordering a reduction of the refrigerator rates to place them on an equality with heating rates, agreed, saying that the refrigeration load factor is better by reason of the more continuous use of energy and that there was nothing in this record to show that the energy consumed by an electric refrigerator should be charged for at a higher rate than energy consumed by the ordinary domestic heating and cooking devices.

LEASE OF WATER RIGHTS IN CONSIDERATION OF CONTRACT AS FACTOR IN VALUATION.—In adjusting the valuation of the West Coast Power Company, the Washington Department of Public Works made several decisions. One of these, relating to the exclusion of unused standby equipment, was noted in the ELECTRICAL WORLD for Oct. 15 (page 808). In addition, the commission decided that the value of water rights leased to another company as part of the consideration for a contract under which power is purchased at reduced rates might be included in the rate base at a figure determined by giving proper consideration to the net savings under the contract and a proper distribution of such savings between the utility and its customers. No separate figure should be allowed, the commission held, for going value when the values already assigned to the various units of property are not those of a bare plant but those of a going concern and the pioneer losses have already been adequately covered in the operating expenses. A return in excess of 14.05 per cent was found to be unfair and unwarranted, and a decrease in rates was ordered so that rates would yield a return of 8 per cent.

Recent Court Decisions

DE FOREST RADIO PATENTS AGAIN SUSTAINED.—Another step in the long contest over radio patents was taken last week when the United States Court at Wilmington, Del., handed down an opinion dismissing the suit of the General Electric Company against the De Forest Radio Company in which it was sought to restrain the De Forest company from making and using radio apparatus on the ground that four basic patents were infringed, covering electrical discharge apparatus and the process of manufacture and use of vacuum tubes. The court decided that the first and main patent of the four is invalid in view of prior art and because it lacked patentable novelty and for other reasons. The court held that only the third patent, covering the use of potassium in radio tubes, was valid.

DAMAGES FOR INJURY TO PROPERTY CAUSED BY NOISE FROM SUBSTATION REFUSED.—In Brady vs. City of Tacoma suit was brought by a householder whose property faces a municipal substation where 110-kv. current is stepped down upon the theory that there had been a taking or damaging of the property without compensation in that it was depreciated in market value and rendered less valuable for use by the unsightliness of the substation, the continuous noise attending its operation and the potential damage to adjacent residents by injury or death from fallen wires or other cause incident to the operations. The substation was admittedly properly built and equipped. The trial court held that there could be no recovery on account of the first and last causes, but found that the plaintiffs were damaged to the extent of $400 by reason of the continuous noise. On appeal by both parties, the Washington Supreme Court reversed the judgment against the city, holding that sounds of commercial and industrial activity must be material, substantial and unreasonable to warrant recovery of damages to adjoining property and that the electric substation was not improperly located so as to authorize recovery of damages to nearby residential property by continuous humming noise. (259 Pac. 1089.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

A. H. Manwaring Retires After 46 Years

ALBERT H. MANWARING, engineer of transmission and distribution of the Philadelphia Electric Company, retired Jan. 1 after forty-six years of continuous and active service. It was in August, 1879, that he entered the employ of the Brush Electric Company, Cleveland, manufacturer of carbon lamps and arc lights and electric light plants, the pioneer electric lighting system in this country. In August, 1881, he became affiliated with the

A. H. MANWARING

Brush Electric Company of Philadelphia as transmission and distribution engineer, which position he held with the Philadelphia Electric Company until his voluntary retirement.

Mr. Manwaring is the inventor of the broad carbon lamp, the tower wagon, electrically operated for trimming arc lamps, the electrically driven pole truck and the cable plow for installing underground cable. In 1892, he organized the Philadelphia Electrical & Manufacturing Company, of which he is president. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Franklin Institute and other associations.

JAMES E. LANNIGAN, vice-president of the Whitaker & Bogardus Realty Company, has resigned to become assistant manager of the Fulton Light, Heat & Power Company of Fulton, N. Y.

ROBERT J. MORAN has been appointed assistant chief of the electrical department of the Philadelphia Fire Underwriters' Association.

LEONARD H. CHURCH, for the last year and a half affiliated with the editorial staff of ELECTRICAL WORLD, first in New York and more recently in Cleveland, is now editorial representative of the *Electric Railway Journal* in Chicago, with the title of assistant editor. For three years previous to assuming editorial duties in New York, Mr. Church was a member of the faculty of the electrical engineering department of the Kansas State Agricultural College, Manhattan, Kan. In addition to his academic work, while in the Middle West Mr. Church served as a consulting engineer in the Red Wing rural project in Minnesota and specialized in rural electrification in Kansas.

A. W. Berresford Heads Engineering Council

A. W. Berresford, for many years prominently identified with the manufacturing branch of the electrical industry was elected president of the American Engineering Council at a meeting held this week in Washington, D. C. The selection of Mr. Berresford places at the head of the council an engineer-executive possessing a wide knowledge of general engineering and a broad background of actual experience in industrial enterprises.

For 22 years Mr. Berresford was identified with the Cutler-Hammer Manufacturing Company, having served in the capacity of vice-president and general manager for a period of almost twenty years. He resigned from this executive position in 1923, and, three years later, became executive vice-president of the Nizer Corporation, following the consolidation of that organization

A. W. BERRESFORD

with the Kelvinator Corporation and the Grand Rapids Refrigerator Corporation, operating as divisions of the Electric Refrigeration Corporation. He severed his connection with the refrigeration branch of the industry last summer. In association work Mr. Berresford has been extremely active, being a past president of the American Institute of Electrical Engineers, the Electrical Manufacturers Club and of the Associated Manufacturers of Electrical Supplies.

P. H. Chase Succeeds Manwaring in Philadelphia

PHILIP H. CHASE, formerly assistant engineer of transmission and distribution of the Philadelphia Electric Company, has been appointed transmission and distribution engineer of the company to succeed A. H. Manwaring, who recently retired. Mr. Chase's first affiliation with the electrical industry was as an employee of the Public Service Electric Company of Newark, N. J., where he spent seven years as assistant to the superintendent of distribution,

P. H. CHASE

supervising distribution and substation operation, and, subsequently, as assistant engineer on electrical station and substation design and construction. In 1917, he became chief electrical engineer in general charge of electrical work on the various properties of the American Railways Company of Philadelphia, now the American Electric Power Corporation. It was in 1921 that he joined the Philadelphia Electric Company.

A native of Hanover, N. H., Mr. Chase received his technical education at the Massachusetts Institute of Technology and at Harvard University. In the course of his engineering career, he has been active in association work, having been at various times president of the Pennsylvania Electric Association, chairman of the technical section and chairman of the overhead systems committee. He has also done extensive work on committees of the American Institute of Electrical Engineers, the Illuminating Engineering Society and the National Electric Light Association.

GERARD SWOPE, president of the General Electric Company, sailed for Europe Jan. 7 aboard the Cunard liner Aquitania to spend a short time abroad.

THOMAS A. EDISON left his home at West Orange, N. J., Jan. 12 to spend the winter at his home in Fort Myers, Fla.

Financial and Statistical News

Call Money Movements Common Stocks at New High Bonds Active and Firm

UNAFFECTED by the rise of call money to a point higher than at any time during 1927, power and light stocks made advances over 1927 high levels, during the first week of the new year. Since that time, the call rate has returned to normal, but, at the same time, utility stocks have receded slightly in accordance with the general trend of the market. The average price of fifteen representative power and light stocks is now 121, against 91 for the corresponding week last year.

Bond prices have also continued to rise, and demand for high-grade issues is very strong. The average price of nine representative power and light bonds, as computed by the ELECTRICAL WORLD is now 105 against 98 this week last year. The last calendar year showed an advance of more than 7 points in this group, and financial men in the industry state that they anticipate no change in this trend. Such a view is supported by a comparison of yields with those on railroad bonds, for example, especially as the investing public is beginning to appreciate the relative merits of power and light company bonds as compared, yield for yield, with those of some other industries.

New England Power to Issue New Stock

The New England Power Company has petitioned the Massachusetts Department of Public Utilities for authority to issue 68,000 additional shares of common stock at a par value of $25 per share to meet the cost of plant additions. Including common stock of the par value of $5,100,000 previously petitioned for, the total par value of the company's securities will be $36,037,000, if the board acts favorably. These securities will consist of $17,000,000 in common stock and $6,814,000 in preferred, both par values, and $2,223,000 in first mortgage bonds, face value. The improvements to which the proceeds of the 68,000 shares are to be applied approximate $1,700,000.

Saluda Dam Project Calls For $17,000,000

Financial plans for the construction of the Saluda Dam, one of the largest hydro-electric projects in the United States, have just been arranged by the Lexington Water Power Company, a subsidiary of General Gas & Electric Corporation. The plan comprises two issues, a $12,000,000 issue of first mortgage 5 per cent, 40-year bonds, and a $5,000,000 issue of 5½ per cent convertible debentures. The former are sold at 98 and interest, and the latter at 98½ and interest.

Great interest has been focussed upon this huge development. The dam to be constructed will have the largest cubical content of any dam in the country and the lake will be the largest artificially created in the country. The capacity of the power house, from the standpoint of average firm kilowatt-hour output, will be exceeded by only one hydro-electric generating station in America, that of the Niagara Falls Power Company. The cost of the development is expected to be approximately $21,000,000.

Provision for the disposal of the huge amount of power which will be available has already been made. Contracts extending until 1980 have been consummated with Carolina Power & Light Company, Duke Power Company and Broad River Power Company.

The debentures will be convertible into $6 cumulative preferred no par stock of the company, after January, 1931, on the basis of 10 shares of such preferred stock for each $1,000 principal amount of debentures, with adjustment for accrued dividends and interest.

Philadelphia Consolidation Involves Expanding Activities

Greater Opportunities and Increasing Demand for Power Will Result in an Increase in the Operating Staffs Rather Than a Reduction

THE probable policy of the dominating company following a merger or absorption is always the occasion of much speculation. In the case of the United Gas Improvement—Philadelphia Electric situation, President Arthur W. Thompson has given out some idea of prospects and economies to be effected. Following are statements from his recent address before the Philadelphia Electric Company section of the National Electric Light Association.

References have been made in the newspapers to economies which might result from this consolidation of interests in Philadelphia. It is not necessary to refer to how this will be brought about to most, if not all of you in the industry. Briefly, when one realizes that, with the Conowingo power brought into the joint territory of these companies, with the coupling up of transmission and distribution lines, with the closing down of many power plants and using them only for peak load purposes, it is then one realizes the economies that can be made.

These references have not been made with the idea of reducing the forces of the Philadelphia Electric Company, or through having The U.G.I. do the work; on the contrary, through the consolidation of the interests, through expansion and development of the territory, will the greatest results be obtained. The U.G.I. proposes to stand by with its efficient personnel, who are engaged in public utility work over a wide area, and who have a wide range of activities, to help the Philadelphia Electric organization wherever possible.

There are opportunities for big steam plants on the Delaware River, and the immense Conowingo development of hydro-electric, through the generation, transmission and distribution of power will be unrivaled, except in some few local places where hydro-electric can carry all of the load.

Philadelphia metropolitan area comprises a territory of approximately 2,000 sq.mi. The present community of interests of the Philadelphia Electric and the U.G.I. opens up a new field of activity for each and every one of you, through the very linking of these properties together. Elimination of waste benefits the consumer, patron or investor and brings opportunity for advancement and promotion to all of you, with prospects for greater compensation.

Of course, if I could not come before you with optimism, with encouragement, I should not be here. This great city or metropolitan area is third in size in the United States and one of the greatest communities of diversified industries in the United States. Power has and will continue to encourage development of this diversified industry and the small industrial plant. When it is known and fully realized that the Philadelphia Electric Company power rates on file with the Public Service Commission of this State gives to the power consumer a rate lower than any other city in the United States except Buffalo, there will be more rapid industrial development here.

More employees, more promotions, more executive positions will be necessary to meet the demand for electric service and, as I have announced previously, the policy of the U.G.I. is to continue not only the charter and the corporate company of the Philadelphia Electric, but to supplement it and bring the various properties together to make these economies. All of which should be and is, no doubt, an incentive to do good work on the part of all of you.

American Water Works Declares Common Extra

The directors of the American Water Works & Electric Company declared a quarterly dividend of 25c. on the common stock and a semi-annual dividend of one-fortieth of a share of common stock on the common stock. Both dividends are payable February 15 to stockholders of record February 1. Previously the company had been paying 2c. quarterly in cash and semi-annual stock dividends of 2½ per cent. The net power output of the electric subsidaries of the American Water Works & Electric Co., Inc., to consumers for the month of November was 138,634,345 kilowatt-hours, compared with 135,721,509 kilowatt hours for the month of November, 1926, a gain of 2 per cent. For the first eleven months of 1927 net power output totaled 1,507,278,844 kilowatt-hours, against 1,348,312,188 kilowatt-hours, a gain of 12 per cent.

Stockholders Approve Combination

Stockholders of the companies involved in the proposed merger with the Public Service Electric & Gas Company voted in favor of consolidation as follows:

In the case of Public Service Electric & Gas Company 11,997,521 shares were voted for and none against; 48,876 shares of Essex & Hudson Gas Company were voted in favor and 7,861 against; 81,589 shares Paterson & Passaic Gas & Electric Company for, 5,967 against; 3,082 shares New Brunswick Light, Heat & Power Company for, none against; 8,123 shares Somerset, Union & Middlesex Lighting Company for, 1,277 against.

Tennessee Electric Will Resume Stock Sale

In conjunction with the Tennessee Electric Power Company's construction program of the new year, involving expenditures of approximately $5,000,000, the company announced the resumption of the sale of its first preferred shares to the people of Tennessee. The price is $100 per share, paying $6 a year dividends, to yield a return of 6 per cent. The company's expansive building and development program and stock sales activities go hand in hand. In the last four years, Tennessee Electric Power's construction expenditures have equalled or exceeded $5,000,000 a year and in this period about $8,500,000 of the company's securities have been purchased by investors in Tennessee. Demand for Tennessee Electric Power preferred shares has been increasing year after year, so much so, in fact, that, in 1927, the company's portion of new capital through stock was placed with investors in the first six months of the year. This necessitated a cessation of the customer-ownership securities' program for the remainder of the year, resulting in numerous inquiries as to the reasons therefor. The present 6 per cent issue has enjoyed a steady increase in price since its offering less than two years ago, superseding a 7.20 per cent issue in effect prior to that. The 6 per cent stock first sold for $90 per share, then $92.50, $95, $97 and now $100. It may be purchased at $100 cash or on a time payment basis of $10 per share, each deposit earning interest at the rate of 6 per cent per annum, when the stock is fully paid for.

Power and Light Maturities Exceed $86,000,000 for 1928

OWING to extensive refunding operations in the public utility field during the last year, bond and note maturities for 1928 have fallen off from $280,413,000 in 1927 to $208,768,000 in the calendar year 1928. Contrary to expectation, however, the power and light total has advanced from $56,042,000 in 1927 to $86,411,000 in 1928, being 41 per cent of the total for all public utilities this year, according to Dow, Jones & Company.

Such an increase, however, is not sufficient to be of any special significance. Refunding in the power and light industry has been carried out on a very extensive scale during the last year, a total of $879,000,000 out of aggregate financing for all purposes, of $2,128,909,000 being for refunding purposes. Such operations have brought about a huge saving in interest charges, possibly $15,000,000 yearly, and they have also helped to simplify and strengthen capital structures as well. The total retirement of $86,000,000 in these issues in 1928 will add materially to this reduction in fixed charges.

Out of the issues maturing in 1928 in the power and light industry, at least four bear 7 per cent interest rates, and the majority are 6 per cent. Interest charges to the extent of probably $5,000,000 are wiped out, disregarding the question as to whether or not these issues are replaced by new offerings. Maturities for 1928 by main classes are:

Industrials	$244,116,830
Pub. Railroad issues	292,156,390
Foreign Govt. issues	144,883,240
Public Utilities	208,768,720
	$889,925,180

A statement of power and light maturities, by months, appears below:

Due	Company	Rate	Amount
January			
Jan. 1	General Pwr. & Lt., 6 mos.	5	$1,750,000
Jan. 1	General Pwr. & Lt., 1-yr.	6	750,000
Jan. 1	Central West Public Service, 6-mos.	5½	1,250,000
Jan. 1	Bloomington & Normal Ry. & Lt., gen.	5	1,164,000
Jan. 1	New Bedford Gas & Edison Lt., 1st A	6	885,000
Jan. 1	Blue Ridge Pwr., 1st	6	500,000
Jan. 1	New Bedford Gas & Edison Light, 1st B	7	477,000
Jan. 1	Central Illinois Public Service, serial	5	400,000
Jan. 1	Manufacturers Power, 1st	6	400,000
Jan. 1	Hutchinson Water, Light & Power, 1st	4	212,000
Jan. 15	Edison Electric Illum. of Boston, 3-yr.	4½	30,000,000
Jan. 15	Southern California Edison, deb.	7	1,000,000
Jan. 15	Detroit Edison, deb.	7	246,000
	January total		$39,034,000
February			
Feb. 1	Hartford Elec. Lt., 3-yr.	7	$4,000,000
	February total		$4,000,000
March			
Mch. 1	Central Arkansas Ry. and Light, 1st	5	$1,854,000
Mch. 1	Consol. Pub. Serv., 1-yr.	5	500,000
Mch. 1	Northern Texas Electric, 5-yr.	7	500,000
	March total		$2,854,000
April			
Apr. 1	East. Coast Utilities, 1-yr.	5	600,000
May			
May 1	Vermont Power & Manufacturing, 1st	5	250,000
	May total		$250,000
June			
June 1	Central Indiana Pwr., 3-yr.	6	$5,000,000
June 1	Elec. Pub. Utilities, 1-yr.	5	1,500,000
June 1	Texas-Gulf Power, 1-yr.	5	900,000
June 15	Central States Edison, 1-yr.	5	850,000
	June total		$8,250,000
July			
July 1	Lake Ontario Pwr., 1-yr.	6	$500,000
July 15	Federal Pub. Utilities, 1-yr.	5	1,000,000
	July total		$1,500,000
August			
Aug. 1	Eastern Texas Elec., 3-yr.	5	4,000,000
	August total		$4,000,000
September			
Sept. 1	United Lt. & Pwr., 3½-yr.	5½	$4,873,000
Sept. 1	Central States Pwr. & Lt., 2-yr.	5½	250,000
	September total		$5,123,000
October			
Oct. 1	Queens Elec. Lt. & Pwr., 1st	5	$250,000
	October total		$250,000
November			
Nov. 1	Columbus Elec. & Pwr., 3-yr.	5	$2,500,000
Nov. 1	Southern Cities Utilities, 1-yr.	5	2,000,000
Nov. 1	Midland Utilities, notes	5	1,500,000
Nov. 1	N'eastern Iowa Pwr., 1st.	6	600,800
Nov. 1	N'eastern Iowa Pwr., 1½-yr	5	300,000
Nov. 2	Edison Electric Illum. of Boston, 1-yr.	4	10,000,000
	November total		$16,900,800
December			
Dec. 1	Com'wealth Pr., serial 1-yr.	5	500,000
Dec. 1	Uncas Pwr., 1st	5	200,000
Dec. 31	Broad River Pwr., 2-yr.	4	2,950,000
	December total		$3,650,000

Electric light and power bonds and notes maturing in

January	$39,034,000	July	1,500,000
February	4,000,000	August	4,000,000
March	2,854,000	September	5,123,000
April	600,000	October	250,000
May	250,000	November	16,900,800
June	8,250,000	December	3,650,000

Elec. light and power maturities in 1928.. $86,411,800

American Gas Plans Stock Increase

A proposal to increase the number of shares of no par common stock of the American Gas & Electric Company from 2,250,000 to 4,000,000 shares will be submitted to the stockholders of that company at the annual meeting to be held Feb. 21. At the annual meeting held last year the common stock of the company was changed from $50 par value to no par value at the rate of five new shares for one old share of stock. If the proposed plan meets with the approval of the stockholders the financial set-up of the American Gas & Electric Company will consist of 4,000,000 shares of no par common stock, 600,000 shares of $6 cumulative preferred stock, $6,282,000 of 5 per cent collateral trust bonds and $46,904,000 of 6 per cent debenture bonds.

Five Utility Offerings

During the second week of January, four electric light and power companies offered new securities to the amount of $26,700,000.

The Lexington Water Power Company floated two loans, one in the form of first mortgage bonds, amounting to $12,000,000, the other in the form of convertible debentures amounting to $5,000,000. The bonds were priced at 98 and interest and the debentures at 95½ and interest.

The National Electric Power Company issued 6 per cent cumulative preferred stock, totaling $5,000,000, the price being $94.50 per share and accrued dividend, to yield 6.35 per cent.

The Gulf States Utilities Company issued 30,000 shares of $6 dividend preferred stock at 100 and accrued dividend. Proceeds from the sale of this stock will be used to provide additional capacity to care for the rapidly expanding business or to reduce notes payable, which on Nov. 30, 1927, amounted to $2,885,000, held by the Eastern Texas Electric Company. One-third of this issue has been reserved by the company for sale in the territory served.

Gold bonds of the Arizona Edison Company were issued to the amount of $1,700,000, the price being 96 and interest, to yield about 5.33 per cent. These bonds, dated Jan. 1, 1928, mature Jan. 1, 1948.

Company Reports

Name of Company	Gross Earnings Twelve Months Ended Nov. 30 1927	1926
American Power & Light	$62,743,819	$58,886,148
Bangor Hydro-Electric	1,870,752	1,707,968
Baton Rouge Electric	1,015,036	946,336
Blackstone Valley Gas & Electric & Subsidiaries	5,907,202	5,467,392
Cape Breton Electric	650,015	607,435
Central Illinois Light	4,372,046	4,168,016
Cities Service	32,925,032	24,465,508
Columbus Electric & Power and subsidiaries	4,192,091	3,711,163
Commonwealth Power	52,837,950	48,887,334
Consumers Power	26,438,745	23,862,848
Detroit Edison	*42,724,849	*40,483,659
Eastern Texas Elec. & subs.	7,133,557	5,577,438
Edison Electric Illuminating of Brockton	1,920,086	1,762,922
Electric Light & Pwr. Co. of Abington & Brockton	622,445	580,829
El Paso Electric	2,992,004	2,804,802
Galveston-Houston Electric and subsidiaries	5,038,616	4,505,672
Illinois Power	2,632,771	2,572,177
Lowell Electric Light	1,790,447	1,713,816
North Texas Elec. & subs.	2,668,920	2,524,395
Northern Ohio Power	12,478,762	12,000,144
Ohio Edison	1,903,720	1,802,910
Penn-Ohio Edison	13,102,094	12,581,239
Portland Electric Power	12,158,668	11,701,528
Puget Sound Power & Light and subsidiaries	14,808,793	13,429,532
Savannah Electric & Power	2,237,544	2,216,304
Sierra Pacific Electric	1,243,246	1,249,271
Southern California Edison	30,487,312	27,533,028
So. Indiana Gas & Electric	3,033,310	2,862,947
Tampa Electric	4,737,109	4,816,505
Tennessee Electric Power	12,472,642	11,961,246
Virginia Elec. & Pwr. & subs.	15,440,586	14,248,838

* Eleven months ended Nov. 30.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 10	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par ex. div	141	83	150½
Ala. Pwr., $7 com. pf.—no par	114	107	115
Allis-Chalmers Mfg., 6% com	117½	88	118½
Aluminum Co. of Amer., com.	a24	67½	145½
Aluminum Co. of Amer., 6% pf	k105½	101½	106½
Amer. & Foreign Pwr., 7% pf.—no par	107	86½	109½
Amer. & Foreign Pwr., com.—no par	23½	18½	31
Amer. Bosch Magneto, com.—no par	21	13	26½
Amer. Brown Boveri Elec.†	17	5½	39½
Amer. Brown Boveri Elec., pf. $7	63	40	98
Amer. Gas & Elec., 6% pf.—no par	108	95½	108½
Amer. Gas & Elec., com. †—no par	119½	68½	125
Amer. Lt. & Trac., 6% pf	115	112	120
Amer. Lt. & Trac., new com	m174	164½	186
Amer. Pwr. & Lt., 6% pf	109½	97½	109½
Amer. Pwr. & Lt., com. †—no par	63	54	73½
Amer. Pub. Serv., 7% pf	a 99	94	104
Amer. Pub. Serv., com. †	k 70	65	75
Amer. Pub. Utilities, 7% ptc. pf	86	73	90
Amer. Pub. Utilities, 7% pr. pf	a 92½	92	96½
Amer. Pub. Utilities, com	k 60	58	70
Amer. States Sec., A	4½	2½	5½
Amer. States Sec., B	4½	2½	5½
Amer. Superpwr., 6% ptc pf.—25	29½	26½	29½
Amer. Superpwr., 6% 1st pf	l102½	....	....
Amer. Superpwr., Class A†—no par	37½	27½	41½
Amer. Superpwr., Class B†—no par	38	28½	43
Amer. Wtr. Wks. & Elec., 6% pf	101½	99½	103½
Amer. W.W. & E., com. new—no par	59½	46	72½
Anaconda Copper cap. $3	56½	41½	60½
Appalachian Electric Pwr., 7% pf	106½	100	109
Arkansas Pwr., & Lt. 7% pf	107	108	110
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	97	85	98
Assoc. G. & E., Class A, 10—no par	49½	35	52
BABCOCK & WILCOX, 7% com.	120	113	132
Binghamton L., H. & P., $6 pf	102½	93	103½
Birmingham Elec., pf.—$7—no par	109	105	111½
Blackstone Valley G. & E., 6% pf	k107	103	110
Blackstone Valley Gas & Elec., 10% com.—50	k128	98	153
Blaw-Knox, com.†	f 95	70	105
Brazilian Trac., Lt. & Pwr., $7 com.	f217	....	....
Broad River Pwr., 7% pf	104½	97	105½
Brooklyn Edison, 8% com	211	148½	225
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 26½	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	f 33½	.....	....
CALIFORNIA ELEC. GENERATING, 6% pf	k 99	96	104½
California Ry. & Pwr., 7% pf	k135	125	150
Carolina Pwr. & Lt., pf.—$7—no par	l109½	107	109
Central & S. W. Util., $7 pf.—no par	a102	92½	99½
Central & S. W. Util., pr. ln. $7 pf.—no par	a107	98½	105½
Central Ark. Ry. & Lt., 7% pf	104½	100	104
Central Ill. Pub. Serv., $6 pf	a 98	85½	100
Central Ind. Pwr., 7% pf	a 95½	85½	95½
Central Maine Power, 6% pf	95	....	....
Central Maine Power, 7%	106	102	110
Central Pwr. & Lt., 7% pf	105	100½	105
Central States Elec., 7% pf	105½	92½	104½
Century Elec., 6% com	b142	114	162
Chicago Fuse Mfg., com.—$2.50 no par	a 33½	30	35½
Cincinnati Gas & Elec., 5% com	g100	96½	101½*
Cities Service, $6 pf.—no par	l 95½	87*	94½
Cities Service, pf. B—no par	l 8½	8*	8½*
Cities Service, pf. BB—no par	l 88½	80½*	86 *
Cities Service, com.—20	l 56	40½	58½*
Cities Service, Bks. Shrs.—10	l 27½	22½*	27 *
Cities Service Pwr. & Lt., 7% pf	105½	100½	106½
Cities Service Pwr. & Lt., 6% pf	96½	90	95½
Cleveland Elec. Illg., 6% pf	112	108	114
Cleveland Elec. Illg., 10% com	350	285	370
Columbia Gas & Elec., 6% pf	109½	99½	110½
Columbia G. & E. com. $5—no par	91½	82½	98½
Columbus Elec. & Pwr., $2 com.—no par	65	....	....
Columbus Elec. & Pwr., 7% pf	107	....	....
Columbus Ry., Pwr.&Lt., 6% 1st pf.	107	98½	108½
Columbus Ry., Pwr. & Lt., 6½% pf. B	105	96	106
Columbus Ry., P. & L. com.—no par	105	75	110
Commonwealth Edison, 8% com	a168	138	173
Commonwealth Pwr., 6% pf	104½	91½	105
Commonw'th Pwr., $2, com.—no par	64½	48½	78½
Conn. Lt. & Pwr., 8% pf	118	119	123
Conn. Lt. & Pwr., 7% pf	112	112	119
Cons. Gas of N. Y., pf	102	93	103
Cons. Gas of N. Y., com. $5—no par	121½	94	125½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf	e111½	110½	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf	e112	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf	e113	112½	117
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf	e127½	127	130½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	e 68½	51	71
Consolidated Pwr. & Lt., 7% pf	105	100	106
Consumers Pwr., 6% pf	104½	100	106½
Consumers Pwr., 6.6% pf	106½	103	107½
Continental Gas & Elec., 8% ptc. pf.	109½	103	110
Continental Gas & Elec., 7% pr. pf.	106½	100	107½
Contl. G. & E. com. $4.40—no par	*k225	210	265
Crocker Wheeler, com.†	23	23	38
Crocker Wheeler, 7% pf	82	78	88
DALLAS PWR. & LT., 7% pf	111	107	111½
Dayton Pwr. & Lt., 6% pf	108	101	109½
Detroit Edison, 8% com	167½	133½	170½
Dubilier Condenser, com.—no par	3½	2	5½
Duke Pwr., cap	135	115	145
Duquesne Lt., 7% pf	115½	114½	117½
EASTERN NEW YORK UTIL., $7 pf	k110½	102	112½
Eastern New York Util. com	k 65	70	75
Eastern States Pwr. $7, com	12½	9	14
Eastern States Pwr., pf	97	90	99
East. Tex. Elec., 7% pf	107	106	109
Edison Elec. of Boston, $12 com. ex. div.	d260	217	267
El Paso Elec. 7% pf	110	105	112½
Elec. Bond & Share, 6% pf	l111	105½	111
Elec. Bd. & Sh. Sec., com. $1—no par	l 76½	67½	80½
Electric Household Util.†	a 15½	11	15½
Elec. Investors, 6% pf.—no par	100½	92	101
Elec. Investors, com.†—no par	41½	32½	47½
Elec. Pwr. & Lt., ctfs. pf.	107½	96	109
Elec. Pwr. & Lt., ctfs., 40% pd	k121½	103½	122½
Elec. Pwr. & Lt., ctfs., com.—no par	29½	16½	32½
Elec. Refrig. cap.†	11½	5½	37½
Elec. Ry. Securities, com.—no par	6½	....	....
Elec. St. Battery com. $5.25—no par	73½	63½	81
Elmira Wtr., Lt. & R.R., 7% pf	k104	99	105½
Empire Pwr., ptc.†	34	....	....
Engr. Pub. Serv., $7 pf.—no par	m107½	93½	108½
Engr. Pub. Serv., com.—no par	34½	21½	39½
Eureka Vacuum Cleaner, com. $4—no par	74½	50	77½
FAIRBANKS MORSE, 7% pf	k109	107	112
F.-M., com.—$3—no par	36½	30½	43½
Federal Lt. & Trac., com $1.40	42½	37½	47
Federal Lt. & Trac., $6 pf.—no par	99½	91½	100
Florida Pwr. & Lt., 7% pf	106	102½	107
Ft. Worth Pwr. & Lt., 7% pf	l113½	108	114½
GALVESTON-HOUSTON ELEC. 6% pf	65	68	85
Galveston-Houston Elec., com	35	26	32
General Cable, Cl. A $1 no par	58	55½	62½
Gen. Elec. $3 com.—no par	135½	81	146½
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com A $1.50—no par	36½	34	47½
Gen. G. & E. (Del.) pf. A $8—no par	k122½	113½	123½
Gen. G. & E. (Del.) pf. A $7—no par	k107½	100	110½
Gen. G. & E. (Del.) pf. B $7	k103½	96	105½
Gen. Pub. Serv., $7 cum. pf., no par	k110	102	112
Gen. Pub. Serv., com., no par	16½	11½	18
Ga. Ry. & Pwr., 8% pf	k125	119	125
Ga. Ry. & Pwr., 7% pf	k113½	106	115
Gt. Western Pwr., 7% pf	l104	....	....
IDAHO PWR., 7% pf	109	103	110
Ill. No. Utilities, 6% pf	k 96	88	97
Ill. Pwr. & Lt., 7% pf	103½	99	104½
Ingersoll Rand com	93	86½	96½
Int. Combus. Engr., com. $2—no par	52½	40½	64
Int. Combustion Engr., 7% pf	104½	101	105½
Int. Util., Class A—$3.50—no par	k 50½	24	53
Int. Utilities, Class B—no par	10	3	11½
Interstate Pwr., pf.—$7—no par	97½	93	100
Interstate Pub. Serv., 7% pf	102	98	104
Iowa Ry. & Lt., 7% pf	k 98½	97	100
JERSEY CENTRAL PWR. & LT. CO., 7% pf	105½	97½	108
Johns-Manville, com.†—no par	119½	55½	126½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, Jan. 7. *l*Bid price Wednesday, Jan. 11. *m*Latest quotations available. †Dividend rate variable. *1928.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 10	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf. $7	k114¼	109	116¼
Kansas Gas & Elec., 7% pf.	l108	103	107½
Kentucky Hydro-Elec., 7% pf.	a102	94½	104
Kentucky Sec., 6% pf.	k 91	83	90
Kentucky Sec., 5% com.	115	100	135
Kentucky Utilities, 6% pf.	k100	95	101
LACLEDE GAS LT., 12% com.	200	173½	267½
Lehigh Pwr. Sec., com.—no par	20½	15	22
Long Island Ltg., 7% pf.	111	107	112½
Long Island Ltg., com.†—no par	169	139	180
Los Angeles Gas & Elec., 6% pf.	104	98	105
Louisville Gas & Elec., cl. A. $1.75	28½	23½	30½
MAN. ELEC. SUPPLY, cap. $5—no par	52	43	132
Manilla Elec., com.†—no par	k 45½	40	60
Maytag Mfg., com. .50—no par	33½	23½	35½
Memphis P. & L., pf.—$7—no par	k109	107	111
Metropolitan Ed., pf.—$6—no par	104½	93	106
Metropolitan Ed., pf.—$7—no par	108	104	110
Metropolitan Ed., com. $5—no par	k 70	60	72
Middle West Utilities, 7% pf.	a120½	110½	119
Middle West Util., 7% pr. lien	a128	117½	127
Middle West Util., com. $6—no par	a128	108	125
Midland Utilities, pr. ln. 6% pf.	a106	97½	107½
Midland Utilities, 7% pf. A	a103½	96½	103½
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	98	101½
Minn. Pwr. & Lt., 7% pf.	l108	104	107½
Miss. River Pwr., 6% pf.	106	94	108
Miss. River Pwr., 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	106	100	109
Mohawk Hudson Pwr., 2d pf.—$7—no par	106	94	107
Mohawk Hudson Pwr., com.—no par	30½	20½	32½
Montana Pwr., 5% com.	103½	81½	109½
Montreal Pwr., 7½% com.	f 90	....	....
Mountain States Pwr., 7% pf.	102½	97	103
Mountain States Pwr., com.†	17	....	....
NASSAU & SUFFOLK LTG., 7% pf.	109	98	110
National Carbon, 8% pf.	a138	130½	139½
National Elec. Pwr., A†.	a 28½	22	28½
National Lt., Ht. & Pwr., com.	k 24	20	30
National, Light, Ht. & Pwr., 5% pf.	k 72	70	80
National Pwr. & Lt., pf.—$7—no par	109	101	111½
National Pwr. & Lt., com.†—no par.	22½	19½	26½
National Pub. Serv., 7% pf.	99½	93	102
National Pub. Serv., 7% pfc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par	22½	18½	24
National Pub. Serv., B com.—no par	k 25½	14	30
Nebraska Pwr., 7% pf.	110	106	109½
Nevada-Calif. Elec., com.	m 34	25	36½
New Brunswick Pwr., 4% pf.	k 60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	k103½	98½	104
New Eng. Pub. Serv., pf. $7	k101	95	100
New Orleans Pub. Serv.—7% pf.	108½	103	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	95	91	100
N. Y. Central Elec., 7% pf.	k102½	101	104
New York Power & Light, 6% pf. no par	m102	....	....
New York Power & Light, 7% pf.	115	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	k109	110	115
Newport News & Hampton Ry., Gas & Elec., 7% pf.	k109	110	115
Niagara Falls Pwr., 7% pf.—25	k 28½	27½	29½
Niagara, Lock & Ont. Pwr., 7% pf.	k115	110½	116
No. Amer., 6% pf.—50	53½	50	55
No. Amer., com.—10	59½	45½	64½
No. Amer. Edison, $6 pf.—no par	k104	96½	105
No. Caro. Pub. Serv., pf.—$7—no par	103½	93	105
Northeastern Pwr., com.	20½	14½	25
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	18½	9½	20½
No. Ont. Lt. & Pwr., 6% pf.	k 98	84	95
No. Ont. Lt. & Pwr., 4% com.	k 72	73	78
No. States Pwr. (Del.), 7% pf.	108½	101	110
No. States Pwr. (Del.), 8% com.	126½	109½	136½
No. Texas Elec., 6% pf.	45	45	70
No. Texas Elec., com.	10	5	36
OHIO BRASS, com. B $4—no par	k 95	74	116
Ohio Brass, 6% pf.	k110	100	111
Ohio Pwr., 6% pf.	104½	96	106
Ohio Pub. Serv., $6 pf.	k103	95	102
Ohio Pub. Serv., 7% pf.	110	103	111
Ohio River Edison, 7% pf.	108½	103	109½
Oklahoma Gas & Elec., 7% pf.	108½	....	....
PACIFIC Gas & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	47½	31	50
Pacific Pwr. & Lt., 7% pf.	l106	102	105½
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 79	75½	80
Penn-Ohio Edison, 6% pf. no par	k 95½	80½	97
Penn-Ohio Edison, 7% pf.	107½	97½	104
Penn-Ohio Pwr. & Lt., 7% pf.	108	99	110
Penn Pwr. & Lt.—$7—no par	l109½	107	109
Penn Wtr. & Pwr., 8% com., new	m 73	47½	75
Phila. Co., 5% pf.—50	k 48½	40	51
Phila. Co., 6% pf.—50	52½	50	53½
Phila. Co., com.—50	k150	85½	153½
Phila. Elec., 8% com.—25	c 55½	46	58½
Portland Elec. Pwr., 7% pf.	102	97½	102½
Portland Elec. Pwr., 6% pf.	75	78	84
Portland Elec. Pwr., 6% 2d pf.	73	55	70
Portland Elec. Pwr., com.	33	22	30
Potomac Elec. Power, pf.	k111	110	111½
Pwr. Sec., pf.—no par	k 60	28	60
Pwr. Sec., com.—no par	k 12	5	15
Public Serv. of Colorado, 7% pf.,	l107	99*	103*
Pub. Serv. of N. J., 6% pf.	104½	98½	105
Pub. Serv. of N. J., 8% pf.	134½	125	135½
Pub. Serv. of N. J., $2 com.—no par	41½	32	46½
Pub. Serv. of No. Ill., 6% pf.	a113½	101½	113½
Pub. Serv. of No. Ill., 7% pf.	a120	112½	120½
P. S. of No. Ill., com. $8—no par	a160½	140½	161½
Pub. Serv. of No. Ill., $8 com.	k160	130½	160
Pub. Serv. of Okla., 7% pr. ln.	k103	90	103
Pub. Serv. Elec. & Gas, 6% pf.	k108½	102	110½
Puget Sound Pwr. & Lt., 7% pf.	k108	105	109
Puget Sound Pwr. & Lt., $6 pf.—no par.	94	....	....
Puget Sound Pwr. & Lt., com.	37½	28	38½
RADIO COPR. OF AMER., $3.50 pf.—50	k 55½	49	57
Radio Corp. of Amer., com.—no par.	104½	41½	101
Rhode Island Public Service, pf. $2—no par	30½	28½	30½
Rochester Gas & Elec. 6% pf. D	k105½	101	103½
Rochester Gas & Elec., 7% pf. B.	105½	105	107
Rochester Gas & Elec., 6% pf. C.	105½	101½	103½
SAN JOAQUIN Lt. & Pwr., 7% pf.	k111	105	112½
St. Joseph Ry., L., H. & P., 5% pf.	k 75	70	75
Servel Corp.	1½	10cts	10½
Sierra Pacific Elec., 2% com.	31½	24½	31½
Sioux City Gas & Elec., 7% pf.	107	99	105½
Southeastern Pwr. & Lt., pf.—$7 no par	l108½	....	....
Southeastern Pwr. & Lt., ptc. pf.	l 85½	....	....
Southeastern Pwr. & Lt., com.—no par	43½	29½	46
So. Calif. Edison, 8% pf.	k 45	36½	40
So. Calif. Edison, 7% pf.	28½	27	29½
So. Calif. Edison, 6% pf.	26½	24	26½
So. Calif. Edison, 8% com.	43½	31½	45
Southern Cities Utilities, 7% pf.	k 70	67	90½
Southern Cities Utilities, com. $4	m 30	23½	42½
Southwestern Lt. & Pwr., A $3	70	60	65
Southwestern Lt. & Pwr., B.	70	60	65
Southwestern Lt. & Pwr., $6 pf.	88½	83	91½
Southwestern Pwr. & Lt., 7% pf.	k110	103	113
Springfield (Mo.) Ry. & Lt., 7% pf.	m102	95	102
Standard Gas & Elec., 8% pf.	65½	57½	66½
Standard Gas & Elec., 7% pr. pf.	110½	103	113
Standard G. & E., com. $3.50	58½	54	65½
Standard Power & Light, com.	31½	22	32
Standard Pwr. & Lt., 7% pf.	104	98	105
Staten Island Edison, pf.—$6—no par	101½	99	103
Superheater, $6 com.—no par, ex. div.	162	170	185 *
Syracuse Lighting, 7% pf.	k111	103	111
Syracuse Lighting, 8% pf.	117½	114	119
TAMPA ELEC., com. $2	62½	49	64½
Tenn. Elec. Pwr., 6% pf.	101½	92	103
Tenn. Elec. Pwr., 7% pf.	109	103	110
Terre Haute, Ind. & East. Trac., 5% pf.	k 26	20	30
Terre Haute, Ind. & East. Trac., com.	k 1	1	3
Tex. Pwr. & Lt., 7% pf.	l114	104	113½
Tide Water Pwr., 8% pf.	108½	105	111
Timken Roller Bear., com.—$4 no par	132½	78	142½
Toledo Edison, 7% pf.	l109	102*	107*
Toledo Edison, 6% pf.	k102	95	105
Toledo Edison, 6% com.	k100	93	102
Tri-City Ry. & Lt., 6% pf.	k 96	96	99
UNITED GAS & ELEC., 7% pf.	102	98	103
United Gas & Elec. (N. J.), 5% pf.	74	70	77
United Gas Impr., 8% com.—50	c112½	89½	118½
United Lt. & Pwr., pf.—$4—no par.	a 55	50	57
United Lt. & Pwr., pf.—$6 .50—no par	a 97	....	....
United L. & P., com. A .48—no par.	14	12½	15½
United L. & P., com. B .48—no par.	k 19	16	21
Utah Pwr. & Lt., 7% pf.	l109½	104	109
Utica Gas & Elec., 7% pf.	105½	105	106½
Utica Gas & Elec., 8% com.	k200	215	225
Utilities Pwr. & Lt., 7% pf.	98	93	100
Utilities Pwr. & Lt., com. A $2	29½	27	34
Utilities Pwr. & Lt., com. B $1—no par	19½	13½	23½
VERMONT HYDRO-ELEC., 7% pf.	k 97	95	100
Virginia Elec. & Pwr., 7% pf.	k108	105	110
WAGNER ELEC., 7% pf.	b 97	68	93½
Wagner Elec., com.—no par	b 38½	18½	39½
Washington Ry. & Elec., 5% com.	455	180	475
Washington Ry. & Elec., 5% pf.	101½	....	....
Washington Wtr. Pwr., 8% com.	k178	136	182
West Penn Elec., 6% pf.	113½	102	112½
West Penn Elec., Cl. A $7	106½	97½	111
West Penn Pwr., 7% pf.	115½	111	118
West Penn Pwr., 6% pf.	k112½	100½	111
West Virginia Lt., Ht. & Pwr., 7% pf.	k 95	94	100
Western Pwr., 7% pf.	k103	98	105
Western States Gas & Elec., 7% pf.	103	96	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50	94½	67½	94½
Weston Elec. Instrument, Cl. A $2—no par	30½	30	34½
Weston Elec. Instrument, com.—no par	k 12½	11	18½
Wheeling Elec., 6% pf.	k103	95	104
Worthington Pump, 7% pf. A	k 46	44	61½
Worthington Pump, 6% B.	k 41	37	54½
Worthington Pump, com.	k 28½	20½	46
YALE & TOWNE com. $5—25,	k 73½	70½	84½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Jan. 7. lBid price Wednesday, Jan. 11. mLatest quotations available. †Dividend rate variable. *1928.

NEW PUBLIC SERVICE ISSUE.—The Public Service Company of New Hampshire has been granted authority to issue $1,800,000 in 4½ per cent first and refunding mortgage gold bonds by the Public Service Commission. Decision regarding the petition of the company to issue 3,400 shares of preferred stock $6 dividend series was reserved. The issue is planned to cover the purchase of electric properties at Salmon Falls, Conway and West Stewartstown.

NEW ENGLAND POWER STOCK ISSUE.—The New England Power Company, Worcester, Mass., has petitioned the Public Utilities Commission for authority to change the par value of its common stock from $100 to $25 and to issue additional common stock to the amount of $1,700,000. The company already has a petition pending with the commission that seeks an issue of additional common stock to the amount of $5,100,000.

WESTERN ELECTRIC PAYS SPECIAL DIVIDEND.—Directors of the Western Electric Company on Dec. 13 declared a special dividend of $13 per share in addition to the regular quarterly dividend of 50 cents per share on the outstanding 3,750,000 shares of no-par-value common stock, both payable Dec. 31 to holders of record Dec. 24.

STOCK PROFITS DISTRIBUTED TO SHAREHOLDERS.—Directors of the Connecticut Power Company, Hartford, Conn., have authorized the distribution to stockholders of a $75,000 profit accrued from the sale of 5,000 shares of stock of the New England Power Company at $65, purchased in 1925 for $50 a share. A payment of $1 a share was paid to stockholders Jan. 5 to stock of record Dec. 27. The Hartford Electric Light Company also authorized a payment to stockholders of the major part of profits of $150,000 from the sale of 10,000 shares of stock for $65 a share, all of which was purchased from the New England Power Association in 1925 for $50 a share. A similar distribution was made to that in the case of the Connecticut Power Company.

EDISON COMPANY TO ACQUIRE ONTARIO POWER SHARES.—Application has been filed by the Southern California Edison Company for permission to acquire the 4,750 shares of preferred stock outstanding of the Ontario (Calif.) Power Company. The Edison company had previously applied for permission to acquire all of the outstanding common stock of the Ontario company.

Business News and Market Conditions

SALES in the industry are light and inquiries have fallen off in virtually all sections of the country. Electrical men point to this condition as seasonal and say that projects ahead indicate an early resumption of activity. In New England small motor sales maintain a good showing and optimism is prevalent despite a slow start. Inquiries show a tendency to lag in the Eastern district but there are indications that sizable commitments will be made both by industrial and central-station plants as well as railways.

In St. Louis manufacturers are optimistic, and several inquiries are reported for oil pipe line pumping equipment. A seasonal lull is noted in the Southeast but there is a reasonable amount of industrial business in prospect. In the Middle West the building outlook is encouraging. On the Pacific Coast many large buildings are projected. A cement company purchased $100,000 worth of switchboard, oil circuit breakers and other equipment, and the city of Tacoma ordered $6,000 worth of current-limiting reactors and a voltage regulator. An appropriation of $65,000 and authority to purchase certain electrical equipment for Seattle's Cedar Falls plant is before the financial and utilities committee of the city council.

Early Orders Expected in Eastern District

While inquiries show a tendency to lag in the Eastern district, market interest is lively, owing to indications that sizable commitments soon will be made both by industrial and central-station plants. One manufacturer states that inquiries are just about one-half as much as in the early weeks of December. An optimistic tone is shown in connection with forthcoming railroad business. Sales have been good during the last few weeks, and, with definite appropriations for electrification work, it is expected that 1928 will produce high records in that line. On the other hand, electric traction sales are extremely light at the moment and a prominent manufacturer of such equipment looks for the slow movement to prevail for a number of weeks. Several utilities are expected to enter the market at an early date for transformers, switching equipment, controls and other substation apparatus. Business in heavy motors and other industrial electrical equipment is holding up well, and the next 30 to 60 days is expected to bring to maturity several orders now pending. Fractional horsepower motors are noticeably weak at present, and not much is looked for in this direction for a number of weeks to come.

Northern New York is developing as a bright spot in the present situation. The Buffalo, Niagara & Eastern Power Company, Buffalo, has placed an order with a large manufacturer for a good quantity of distributing equipment for local installation, and is scheduling an active year for work of this character. Another utility in this section will soon give a contract for a heavy amount of substation apparatus. The Plattsburg Power & Electric Corporation is concluding arrangements for the acquisition of the hydro-electric power plant of Peck Brothers at Shushan, Washington County, and will tie in with its system. The new year shows advancing activity in the Baltimore district and good central station business is anticipated in this quarter. The Consolidated Gas, Electric Light & Power Company of Baltimore will be actively interested in the proposed hydro-electric power plant to be located on the Susquehanna River, south of Holtwood, Pa., on which initial work will soon begin. The ultimate project will cost close to $20,000,000.

Current construction operations in the Eastern district include the following: The Public Service Electric & Gas Company, Newark, N. J., plans a substation on Peace Street, New Brunswick, to cost about $75,000. Jersey City, N. J., plans a marine terminal on the Hudson River waterfront to cost approximately $10,000,000, Harrison, N. J., plans installating an ornamental lighting system on Fourth Street. The American Gas & Electric Company, New York, plans a steel-tower transmission line from site of its proposed power plant at Churchtown, near Pennsville, N. J., to a connection with the system of the Atlantic City Electric Company, estimated to cost $1,000,000.

Volume of Metal Sales Higher at Steady Prices

Sales of most of the non-ferrous metals have been of average volume. Prices, in general, have shown little change, with the exception of tin which has declined over a cent during the week in view of a weaker market in London.

NEW YORK METAL MARKET PRICES

	Jan. 4, 1928 Cents per Pound	Jan. 11, 1928 Cents per Pound
Copper, electrolytic	14⅛	14.05-14.125
Lead, Am. S. & R. price	6½	6½
Antimony	10⅞	10⅞
Nickel, ingot	35	35
Zinc spots	5.95	6
Tin, Straits	10⅜	56⅛
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Jan. 11, 1928, 15½ cents.

In fact, all the metals have been weaker in London in the last two or three days. Though it is the general impression that the copper market is very quiet, the total domestic sales have been the highest since the first week of December, and not far below an average week's business. Buying has been fairly well distributed between rolling mills and brass manufacturers. More than the usual proportion has been taken by Middle Western consumers, reflecting greater activity in automobile lines, especially Ford.

Sales in New England District Are Light

Sales of electrical supplies and equipment in the New England district are light. Central-station orders were confined to a few purchases of switch and control apparatus, one of which for about $5,000 was noted. Heavy equipment interests lagged and inquiries are few. Small motor sales, alone, maintain a good showing and orders for a number of ratings from 10 hp. up to 30 hp. are recorded. One representative reports an increase in demand for motor-connected pump units, and another reports elevator-control apparatus is attracting more attention than at this time last year. Scheduled material is in steady demand, though the orders are for small lots as a rule. A prominent manufacturer forecasts normal business prospects for the coming year. General optimism prevails, despite what appears to be a slow start.

Heavy Building Planned on Pacific Coast

Projected construction, recently announced on the Pacific Coast includes the new plant of the Loyola University near Los Angeles, worth $5,000,000, the $1,250,000 Bar Association Building and the $800,000 medical building, both of Los Angeles, and a $600,000 apartment house, the $400,000 Y.M.C.A. hotel and the $2,000,000 Olympic Club of San Francisco. New hospitals are projected for East Oakland and the University of California campus in Berkeley. Street lighting plans for Shattuck Avenue in Berkeley, Waverley Avenue in Palo Alto and for the city of Tulare are now being prepared. An airport for Livermore is projected. Machinery orders reported include eight assorted motors sizes 5 hp. to 50 hp., valued at $8,000, for a steel company in the Bay region. A 100-hp. synchronous compressor motor, valued at $2,000, for a chemical company. A 55-hp. oil well motor, complete with transformer and accessories, valued at $3,500, and six transformers, size 50-kva., valued at $4,000 for the Kern Oil Fields; a motor-driven air compressor, valued at $6,000; a lightning arrester, valued at $3,000 for the Truckee District, six assorted transformers, 50 kva. and 75 kva., valued at $4,500, for a mining company and motor generator sets and accessories, valued at $6,000 for the United States Navy Yard at Mare Island, an order for 32 duplex electroliers, valued at $7,000, is reported as

an extension to the Modesto lighting system. There are about 50 in. of snow on the Sierras, a little better than the average. All natural business factors are excellent.

The majority of Seattle jobbers report inventory will be completed within ten days' time and that last week's sales established a new record for a like time and period. Equipment costing $100,000 was purchased by the Superior Portland Cement Company at Concrete, Wash.; $6,000 of current-limiting reactors and one induction-type single-phase voltage regulator for the city of Tacoma, and about 75 motors, ranging from 100 hp. down distributed among out-of-town dealers, lumber mills and industrial plants. An appropriation of $65,000 and authority to purchase certain electrical equipment for Seattle's Cedar Falls plant is before the finance and utilities committees of the city council. Construction projects are as follows: The Gila Bend Light & Power Company, Gila Bend, Ariz., plans a power plant to cost about $35,000; and also a local street-lighting system; the Salt River Valley Water Users' Association, Phoenix, Ariz., plans a transmission line and pumping plants in connection with a proposed irrigation project to cost about $6,000,000; Los Angeles, Calif., plans a lighting system on Bronson Avenue, and portions of Fourth, Fifth and Martland Streets, as well as on the Harbor Boulevard and Valley Spring Lane; the Pacific Gas & Electric Company will extend its power plant at Napa, Calif.; Sacramento, Calif., plans a lighting system on a number of streets, with underground conduit lines; San Francisco, Calif., will install an improved lighting system on Golden Gate Avenue; Stockton, Calif., plans an early call for bids for an ornamental lighting system on Center and Main Streets, and Weber Avenue, to cost about $75,000; Tulare, Calif., plans a lighting system in the business district; Southern California Edison Company will build a new substation at San Marino; the Mountain States Telephone & Telegraph Company will extend its central station at Meridian, Idaho, to cost $35,000, and the Peru Mining Company, Deming, N. M., plans a milling plant to cost in excess of $125,000.

Seasonal Lull Evident in Southeast

A seasonal lull is evident in the electrical field in the Southeast, and central-station companies are purchasing mostly for immediate requirements. The only large order placed was by a new motor-assembling plant and called for power transformers totaling 1,500 kva. and distribution transformers aggregating 1,325 kva. There is a reasonable amount of other industrial business in prospect but no immediate announcements are expected. The demand for transformers and meters continues satisfactory, one central-station company purchasing small power and distribution transformers totaling $14,700, while its house type meter orders aggregated $8,000. Some other central-station orders during the past ten days called for switch house and switching equipment amounting to $5,100 and bushings and arresters totaling $3,100. Two municipalities in Georgia recently placed orders for poles for maintenance work, one order amounting to $1,000 and the other $600. Another Georgia town ordered white-way equipment totaling $7,000.

A large restaurant being built in a Georgia city contemplates the purchase of electric ovens and miscellaneous heating appliances to the extent of $3,000 and orders will undoubtedly be placed this week. The Georgia Power Company will construct 6 miles of 2,300-volt 3-phase line for the purpose of supplying service to the towns of Belleville and Manassas and also will construct a multiple street-lighting system in the latter town.

Construction projects are as follows: The Florida Public Service Company has purchased property at Fort Meade, Fla., and plans construction of a substation. The Lavonia Cotton Mfg. Co., Lavonia, Ga., will soon begin the complete electrification of its mill, estimated to cost $50,000; the Georgia Power Company plans a transmission line from Louisville to Waynesboro, and to Vadalia, Mount Vernon and McRae, with a substation to be built at the last noted place; Waynesboro, Miss., plans an ornamental lighting system in the downtown district; the Carbide & Carbon Chemical Corporation, South Charleston, W. Va., plans rebuilding the portion of its plant recently destroyed by fire with loss of more than $350,000.

Manufacturers Optimistic in St. Louis District

The feeling expressed by manufacturers and power company officials regarding business in the St. Louis district is optimistic. Inquiries have been received for oil pipe-line pumping equipment, and local contracts were closed for two 1,500-kva. transformers and one 80-kva. generator. In the western part of the district an order was placed for switching equipment valued at $33,000 and circuit breakers amounting to $1,300. An order from the southwest section called for lift-bridge equipment, consisting of motors and control and amounting to $4,500. Jobbers report a fair general business and a good movement of building materials.

Construction projects are as follows: Bentonville, Ark., plans an ornamental lighting system in the business district; the Arkansas Power & Light Company will improve its Woodward and Dixie substations, and will construct a 110,000-volt transmission line between the two points, at an estimated cost of $450,000; Kansas Power & Light Company, Atchison, Kan., plans additions to its ice plant; the Bastrop Ice & Storage Company, Bastrop, La., plans an addition to its ice plant to increase the capacity to 60 tons; the City Ice Company, Kansas City, Mo., plans, an ice plant at Fifteenth and Winchester Streets; the Southwestern Light & Power Company has contracted with Chickasha, Okla., for a lighting system in the business district; the Texas Electric Service Company plans a transmission line from Wichita Falls to Dundee, Tex.; Central Power & Light Company plans improvements in its power plant at Laredo, Tex., to cost close to $250,000; the Texas Power & Light Company will construct a transmission line from Lufkin to Huntington, Tex.; the San Antonio Public Service Company plans the addition of a 30,000 kw. unit at its Comal power plant at New Braunfels and the Woldert Peanut Products Company, Tyler, Tex., plans rebuilding the portion of its plant recently destroyed by fire with a loss of about $400,000.

Building Outlook Encouraging in Middle West

The Middle West apparently got off to a good start the first week of the new year. Final reports of inventories indicate normal stocks on hand and a general good condition. Week end reviews report an entirely optimistic attitude toward the coming year, with expressed determination to make 1928 equal, or surpass, 1927. The building outlook is encouraging, heavy awards for highway construction are anticipated, and large track accessory purchases were made this week, approximately 20,000 tons being placed since Jan. 1. The various utility companies will undoubtedly continue their conservative policy of purchasing which proved so successful last year. Among the interesting items placed this week were 655,000 lb. Muntz metal condenser tubes, complete coal storage and reclaiming equipment with appurtenances, and two ash sluicing pumps with appurtenances. Jobber's sales are about normal for this period of the year. A survey of last year indicates increased sales of appliances except fan motors, and 1928 is expected to equal this record.

The Bennett Organ Company, Blue Island, Ill., plans an addition to cost $200,000; Champaign, Ill., plans a lighting system to cost $35,000; the Elgin National Watch Company, Elgin, Ill., plans a new addition, estimated to cost $450,000; the Indiana Board of Agriculture, Indianapolis, Ind., has approved plans for an improved lighting system at the State Fair Grounds; the Central States Power & Light Company has approved plans for an addition to its power plant at Iowa Falls, Iowa, to cost about $300,000, and also will extend transmission lines; Sidney, Iowa, plans a municipal power plant; the Wolverine Tube Company, Detroit, Mich., plans extensions in its plant to cost about $300,000; the Lansing Ice & Fuel Company, Lansing, Mich., plans extension in its ice plant; Benson, Minn., has authorized plans for a municipal power plant and system; the Public Service Company has authorized the construction of a transmission line to Edmore, N. D., and vicinity; the Cleveland Electric Illuminating Company, Cleveland, plans an addition to its storage plant on Miles Avenue.

Activities of the Trade

Westinghouse Gets Order for Ten Electric Cars

L. S. Miller, president of the New York, Westchester & Boston Railway Company, has announced the placing of an order for ten additional electric passenger cars with the Westinghouse Electric & Manufacturing Company. These new cars are to be put into operation on a new extension which the New York, Westchester & Boston Railway is constructing between Harrison and Rye, N. Y., and which will be finished about next spring. The cars are 72 ft. over all in length and will be equipped with Westinghouse single-phase motors and control.

Pacific Coast Contract Let to Pelton and General Electric

The city of Seattle, Board of Public Works, has awarded contracts on three items of the $145,000 worth of hydro-electric generating equipment for the No. 6 unit of Cedar Falls. Contract for an 18,000-hp. turbine, costing $60,285, and a 325-hp. water wheel, costing $4,985, for driving an exciter, was let to the Pelton Waterwheel Company of San Francisco. A contract for three 5,000-kva. transformers, costing $24,885, was also let to the General Electric Company.

Woodward Governor to Hold School of Instruction

Following a practice inaugurated last year by the Woodward Governor Company of Rockford, Ill., the company will hold at its factory during the last day of January and the first three days of February, 1928, a school of instruction on the care, operation and theory of governor-operation in general. The school will deal strictly with governor problems and is open to anyone interested. The company states that it will provide the school and the instruction so that power companies and anyone interested may send their representatives to attend the school at their own expense.

General Electric Establishes Contributory Pension Plan

A contributory pension plan whereby employees pay a small part of their wages from year to year to a pension fund, supplementing the old-age pension system which the General Electric Company has had in effect since 1912, has been announced by Gerard Swope, president of the company. At the same time Mr. Swope announced the creation of a pension trust. Instead of the company carrying a reserve on its balance sheet sufficient to meet its obligation to employees reaching the retiring age, $5,000,000 has been turned over to the trustees of the new trust by the company.

Pensions at present are computed at 1½ per cent of the earnings of employees for each year of continuous service. Under the contributory plan of additional pension which it is proposed to make effective Jan. 1, 1929, 1½ per cent of the annual earnings of the employees will be turned over to the custodians, a board of seven, on which the employees will have representation. This money will be invested and held for the employees individually. Interest will be allowed to accumulate. The retiring age in the past has been 70 years for men. Under the new plan it is proposed to make this 65 years for men and, as at present, 60 years for women. At the time an employee reaches the retiring age the custodians of the fund will pay the accumulated amount in full or in installments. If an employee leaves the service of the company or dies before reaching the pension age, the amount accumulated, with interest, will be given him or his estate.

General Electric Orders for 1927 Decrease 5 Per Cent

Orders received by the General Electric Company during the year 1927 amounted to $309,784,623 compared with $327,400,207 for 1926, a decrease of 5 per cent, Gerard Swope, president, has announced. For the three months ended Dec. 31, orders amounted to $76,708,532 compared with $80,406,570 for the final quarter of 1926, also a decrease of 5 per cent. Sales billed and earnings for the year will be announced the latter part of March, when the annual report of the company is published.

Allis-Chalmers Company to Build Plant in Seattle

The erection of a three-story plant at First Avenue, South, and Atlantic Street, is planned by the Allis-Chalmers Manufacturing Company, Milwaukee. Work is scheduled to begin March 1 on a concrete structure, 60x150 ft., to cost about $100,000. The plant will be used for manufacturing and assembling purposes.

THE CLAY PRODUCTS COMPANY, INC., Brazil, Ind., manufacturer of "Super-Quality" vitrified clay conduit, announces a change in its marketing policy. Except in a few isolated territories, the company will sell directly to the customer, instead of through distributors, as in the past. The company expects, through this arrangement, to furnish better service, and to assure the quality of the delivered conduits. Frank N. Gormley will remain in charge of clay conduit sales.

THE EUREKA VACUUM CLEANER COMPANY, Detroit, announces that on Dec. 14 it produced the two-millionth Eureka vacuum cleaner. Unlike its predecessors, this units is made of black velvet, rhinestones and gold. After being displayed at one of the company's major branches, it will be placed in a permanent exhibition at the Detroit offices of the company, along with the millionth cleaner.

THE HENKEL MANUFACTURING COMPANY, 122 South Michigan Boulevard, Chicago, announces an electric fixture-mirror-cabinet combination known as the "Edge-Lite" for bathrooms. The combination has an adjustable lighting fixture which can easily be placed on any of the three sides of the mirror by sliding it in a grooved slot in the frame.

THE ELECTRIC VACUUM CLEANER COMPANY, INC., Cleveland, announces that Ralph B. Wilson, who joined the organization in 1920 as manager of central station sales, has been appointed vice-president and general sales manager. Harry C. Hahn, who has been Mr. Wilson's assistant for the last several years, has been named as the new head of the central-station sales department of the company.

THE GILLETTE-VIBBER COMPANY, New London, Conn., manufacturer of "Gee-Vee" electrical specialties, announces a new type of "Gee-Vee Endo," a split-type fitting for clamping on the ends of armored cables.

THE PARKER-KALON CORPORATION, New York City, manufacturer of metallic drive screws, announces that its factory and general offices will move from 352 West Thirteenth Street, to 200 Varick Street, New York City on Dec. 1.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson, Md., announces a combination grinder and buffer furnished with a 5-in. grinding wheel and a 6-in. wire wheel brush. The company has also placed on the market a new ball-bearing ½-in. electric drill.

THE OHIO BRASS COMPANY, Mansfield, Ohio, announces the opening of an office at 721 Healy Building, Atlanta. K. V. Farmer, H. H. Hoxie, J. A. Whatley and G. W. Willis, sales representatives of the company in that part of the country, will be stationed at that office.

THE LINCOLN ELECTRIC COMPANY, Cleveland, announces the transfer of John Van Horne from Atlanta to Moline, Ill., where he will be found at 514½ Fifteenth Street, covering the Tri-Cities for the sale of "Linc-Weld" motors and "Stable-Arc" welders. He will operate under the direction of R. D. Malm, Western manager at Chicago.

New Equipment Available

"Switch Start" Motor

A new "Switch Start" motor built in sizes from ½ hp. to 30 hp. for either two-phase or three-phase, 60-cycle current has been placed on the market by the Lincoln Electric Company, Cleveland. This motor is so designed that it can be started directly across the line and the starting current will be below the requirements of the National Electric Light Association. The chief claim of the manufacturer for the motor is that operating characteristics, such as power factor, efficiency, maximum torque, temperature rise, etc., have not been sacrificed in order to secure low starting currents.

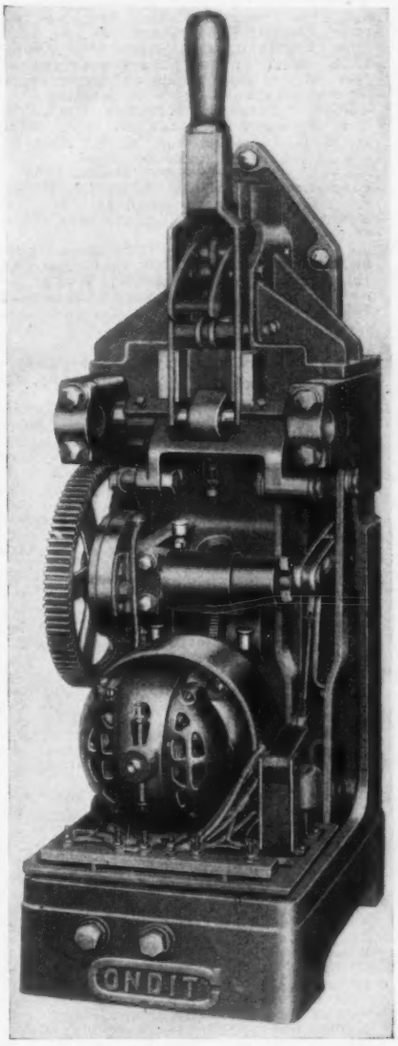
Tests made by the manufacturer show that starting torques of from full load to better than 250 per cent of full load, depending on the horsepower and speed, are possible without exceeding the N.E.L.A. requirements as to starting currents. The torque curve of the "Switch Start" motor shows a gradually increasing torque up to the maximum torque point. On sudden high overloads it is claimed that the "Switch Start" motor also has a very high or maximum pull-out torque. The line is of welded steel construction and is normally equipped with sleeve bearings, although ball bearings will be furnished at the customer's request. Large shafts, large bearings and waterproofed insulation are claimed for these motors.

Fuse and Disconnect Cut-Out

A double-duty fuse and disconnect cut-out which will act as a protective unit has been developed by the James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis. The cut-out acts as a protective unit by having a higher rupturing capacity. The housing and handle are made of vacuum plastic wet-process porcelain. The manufacturer states that the horn fiber used in the construction of this cutout is specially treated and seasoned and a coat of Bakelite varnish applied to exclude moisture. The cartridge contacts are made of materials of high resilient qualities, and the brass line contact castings are of generous proportions. The cut-out is available in eight different types.

High-Speed Circuit-Breaker Closing Mechanism

An oil circuit breaker closing mechanism (type MO-1) of compact design has been developed by the Condit Electrical Manufacturing Corporation, Boston. It consists essentially of a combination of springs, mechanism and a motor through which stored energy is released for closure at will or automatically. The actuating spring is always under tension ready for closure, as the motor sets the spring after each closing operation. Less than one-fourth second elapses between the energizing of the release coil and the closing of the breaker. After closing, from five



OIL CIRCUIT-BREAKER CLOSING MECHANISM. AN EXTERNAL TIMING RELAY WILL PROVIDE AUTOMATIC RECLOSING

to ten seconds is taken by the motor in storing energy in the spring for the next operation, depending on the size and type of breaker. Automatic reclosing may be obtained by using an external timing relay. The mechanism is well adapted to panel, panel frame or wall mounting in substations or isolated switch houses. It can be furnished as follows: Automatic trip-free with one, two or three coils; transformer trip or two-coil series trip. It can be operated from a 200-watt potential transformer. The mechanism is specially adapted to the operation of moderate capacity breakers for synchronizing purposes and for automatic change-over switching.

Dust-Tight and Oil-Immersed Starting Equipment

For special applications the Westinghouse Electric & Manufacturing Company is now building two modifications of its standard equipment of "Line-starters." One of these has special provision for excluding dust. Another modification has all of its parts in which sparks or arcing might occur immersed in oil. Another development is a water-tight and gas-tight push-button station, in which all the elements that operate to open and close the circuit and on which there may be sparking are inclosed in an air-tight chamber.

Low-Voltage Terminal

A new type of low-voltage terminal for indoor or station service has been recently placed on the market by the Standard Underground Cable Company, Pittsburgh. It is designed for mounting on the end of pipe conduit or connected to the sheath of a lead-covered cable by means of a stuffing box gland or a plumber's wiped joint. The line is made of cast iron with bakelite insulating tops and conductor outlets, the joints being rendered moisture-proof by liberal gaskets. These terminals are suitable for terminating low-voltage power or control cables or similar low-potential conductors.

IMMERSION HEATER.—An electric immersion heater for electroplating solutions and other liquids which will not attack lead has been developed by the General Electric Company. It is primarily intended for low-temperature heating only. The unit consists of a steel-sheathed helicoil unit covered with a lead jacket swaged tight to the steel unit. The terminals are brought into a terminal box suitable for conduit connections. It is made in two sizes, both for a maximum demand of 5 kw., one for 110-volt circuits and the other for 220-volts. Only the lower portion of the heater dissipates heat. The upper portion, being inactive, allows the unit to be used in tanks in which the level of the solution may be as low as 10 in. from the top of the tank. The heater can be supplied in different formations.

NEON LIGHT FOR AVIATION USE.—A new type of quartz neon gas-filled lamp for aviation use has been developed by research engineers of the General Electric Company. The lamp, which resembles a ball of reddish orange fire when in use, emits all its visible radiations in the long wave lengths, which tests have shown to have greater fog-penetrating power than light higher in the spectrum. It was found that during a heavy morning mist, when the laboratory building in which the new lamp was housed could not be seen 500 ft. away, the brilliant red glow penetrated to a distance of half a mile or more.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 20, 1927)

1,652,999. ELECTRIC MOTOR; S. C. Benson, Cleveland, O. App. filed Oct. 25, 1921. Means for automatically cutting off the electric supply and to stop the motor, whenever objectionable sparking occurs at the commutator and particularly when the armature coil opens.

1,653,014. INDUCTION HEATER; E. E. Kittredge, J. A. Forster and R. D. Johansen, Alameda, Calif. App. filed Aug. 10, 1926.

1,653,031. SIGNALING SYSTEM; F. Zogbaum, New York, N. Y. App. filed Jan. 19, 1922. In which switches or other objects may be remotely controlled and supervised.

1,653,070. RESISTANCE REGULATING APPARATUS FOR ELECTRIC WELDING; A. Smith, San Mateo, Calif. App. filed April 20, 1925.

1,653,078. RELAY; F. H. Winter, Schenectady, N. Y. App. filed Jan. 12, 1927. Differential relay.

1,653,086. ELECTRIC SWITCH; C. Christensen, Chicago, Ill. App. filed March 13, 1923. Oil break type.

1,653,107. SINGLE PHASE TRANSFORMER; W. Kochling, Waidmannslust-Berlin, Germany. App. filed May 17, 1927. Having a magnetic core with an uneven number of winding legs such as three, five, and so forth, the windings being so arranged that the magnetic flux in adjacent winding legs flows in opposite directions.

1,653,117. SUSPENSION INSULATOR; J. M. Peck, Honeoye Falls, N. Y. App. filed June 26, 1925.

1,653,141. ELECTRODE HOLDER; J. E. Woodland, Richmond Hill, N. Y. App. filed June 23, 1926. For holding the carbon electrodes in motion picture machines and similar apparatus.

1,653,177. FLOW INDICATOR; A. Herz, Chicago, Ill. App. filed Dec. 26, 1924. Also for use as low water alarm.

1,653,195. TRIPPING DEVICE FOR ELECTRIC SWITCHES; J. D. Wood, Quincy, Mass. App. filed Nov. 3, 1924.

1,653,251. TEMPORARY FASTENING MEANS FOR OUTLET BOXES; J. C. Boyton, Cleveland, O. App. filed July 9, 1926.

1,653,267. DEVICE FOR PULLING CABLES AND FLEXIBLE CONDUITS; D. H. Garber, deceased, by G. E. Dunn and A. C. Neer, Indianapolis, Ind. App. filed Aug. 7, 1924.

1,653,283. CIRCUIT MAKING AND BREAKING DEVICE; S. B. Hood, Minneapolis, Minn. App. filed July 31, 1924. Using a liquid medium, such as mercury.

1,653,365. INCANDESCENT ELECTRIC LAMP; C. F. Lorenz, East Orange, N. J. App. filed June 28, 1923. For projection purposes.

1,653,367. MISCH METAL WIRE; J. W. Marden and M. N. Rich, East Orange, N. J. App. filed Jan. 29, 1925. The production of misch metal in a form suitable for introduction into vacuum devices to serve as a clean-up agent and method of fabricating in ribbon form.

1,653,375. PROTECTIVE DEVICE; B. E. Shackelford, East Orange, and W. H. T. Holden, Bloomfield, N. J. App. filed Feb. 15, 1921.

1,653,376. ARC WELDING MACHINE; J. S. Skelly, Monongahela, Pa. App. filed April 8, 1925. Adapted for use in welding the edges of the plates of an air-heating element or similar article.

1,653,378. METHOD OF MAKING BIMETALLIC WIRE; B. F. Steel, East Orange, N. J. App. filed July 1, 1922.

1,653,385. LAMP MOUNT; E. W. Beggs, Glen Ridge, N. J. App. filed Nov. 16, 1923. For lamp operated at a high temperature and utilized as a light source for projection apparatus.

1,653,404. AUTOMATIC RECLOSING MECHANISM; G. H. Middlemiss, Birmingham, England. App. filed June 20, 1924.

1,653,436. INSULATOR; H. P. Liversidge, Bala, Pa. App. filed July 22, 1918. Having band or sleeve shrunk on the insulator for subsequent connection with a top or base, as by co-operating screw threads or other desirable mechanical means.

1,653,443. CONTROLLER FOR ELECTRIC ELEVATORS; E. B. Thurston, Toledo, O. App. filed Nov. 19, 1926. Using polyphase alternating current motors.

1,653,504. TRANSFORMER; E. Moxter, St. Louis, Mo. App. filed Nov. 22, 1923. Secondary current selectively effected independently of any change or variation in the voltage of the primary current and independently also of any variation or change in the structural factors and ratio of both the primary and secondary windings.

1,653,565. METHOD OF BUTT WELDING BY MEANS OF AN ELECTRIC ARC; W. F. Heineman, Shorewood, Wis. App. filed Aug. 13, 1926.

1,653,579. STORAGE BATTERY ATTACHMENT; P. M. Marko, Brooklyn, N. Y. App. filed July 24, 1926. To permit the use of a "trickle" charger with the battery.

1,653,584. INSULATOR SUPPORT FOR WIRES; P. L. Peterson, Worcester, Mass. App. filed March 27, 1926. For securing twin wires to the side of a pole or post.

1,653,599. DISCHARGE BAR FOR NEUTRALIZING STATIC ELECTRICITY; W. H. Chapman, Portland, Me. App. filed April 8, 1927. Such as are placed near the surface of textile fabrics or paper in the process of manufacture or printing.

1,653,600. ELECTRIC BATTERY CELL UNIT AND PROCESS OF MAKING THE SAME; H. M. R. Dam, Astoria, N. Y. App. filed Dec. 15, 1924. Of the flat type.

1,653,602. THERMOSTATIC DEVICE; W. C. Lindemann and E. A. Rutenber, Milwaukee, Wis. App. filed April 24, 1923. For automatically controlling the temperature of ovens and the like.

1,653,605. METHOD OF PROTECTING CARBON OR GRAPHITE ELECTRODES IN FUSED ELECTROLYTES; E. A. Ashcroft, Waye, near Ashburton, England. App. filed Feb. 23, 1927.

(Issued Dec. 27, 1927)

1,653,614. STORAGE BATTERY SEPARATOR; R. C. Benner, Bayside, N. Y. App. filed Oct. 9, 1922.

1,653,659. THERMOSTATIC CONTROL DEVICE; H. E. Reeve, Deceased; by Helen Reeve, Executrix, New York, N. Y. App. filed March 21, 1922. For automatically making and breaking a power circuit or for otherwise exerting power greater than that supplied by the direct action of a thermostat upon change in temperature.

1,653,669. COMBINATION FLASH LIGHT AND CIRCUIT TESTER; B. M. Rydzy, Michigan City, Ind. App. filed June 29, 1923.

1,653,671. LIGHTING FIXTURE; E. O. Schweitzer, Chicago, Ill. App. filed April 4, 1923. Of the wall or side bracket type.

1,653,672. WATER HEATER; R. L. Shriner, Weehawken, N. J. App. filed March 6, 1926. For domestic use.

1,653,724. PLUG; C. Moline, Multnomah, Ore. App. filed May 7, 1926. Quick detachable plug to connect a flexible cord to a socket or receptacle.

1,653,731. ANODIC CURRENT ACCUMULATOR BATTERY; G. Reinstrom, Wandsbek, near Hamburg, Germany. App. filed April 7, 1926.

1,653,751. ELECTRIC CIGARETTE LIGHTER; S. Wagner, New York, N. Y. App. filed March 5, 1927.

1,653,776. MULTIPLE-POINT PLUG; O. E. Marvel, Dayton, O. App. filed March 12, 1923. For handling a large number of circuits in a comparatively small space.

1,653,778. ANTITHEFT ALARM DEVICE; J. Nawarynski, Cleveland, O. App. filed April 18, 1927. For sounding an alarm when a window is raised.

1,653,784. WINDING FOR ELECTRICAL MACHINES; L. Roebel, Mannheim, Germany. App. filed April 16, 1927. The construction of the coil heads or connectors interconnecting spaced bars of coils disposed in slots on the periphery of dynamo-electric machines.

1,653,797. ELECTRIC STOVE; E. D. Brand, London, Ont., Canada. App. filed Oct. 16, 1924. Heavy duty.

1,653,801. DRY CELL; H. de Olaneta, New Haven, Conn. App. filed Aug. 18, 1920.

1,653,810. ELECTRIC LIGHT FIXTURE; J. Markel, Buffalo, and C. W. Logan, Kenmore, N. Y. App. filed March 31, 1927.

1,653,823. CONTACT DEVICE FOR KEY SWITCHES; R. Pudelko, Zug, Switzerland. App. filed Oct. 6, 1924.

1,653,833. CONNECTOR FOR BATTERY TERMINALS AND OTHER ELECTRICAL CONDUCTORS; H. E. Atkinson, Traverse City, Mich. App. filed Sept. 17, 1925.

1,653,845. COOLING OF DYNAMO ELECTRIC MACHINES; P. Faber, Baden, Switzerland. App. filed June 18, 1925. A cooling system having an independently propelled fluid-circulating machine for supplying cooling fluids to the machine, and automatic means for protecting the machines upon failure of the cooling fluid supply.

1,653,855. CATENARY SUSPENSION SYSTEM; J. Holzel, Pasing, near Munich, Germany. App. filed Dec. 13, 1926.

1,653,868. BURGLAR ALARM; H. J. Murray, Brooklyn, N. Y. App. filed Jan. 17, 1920.

1,653,872. METHOD OF MANUFACTURING ELECTRODES FOR BATTERIES; D. Pepper, Philadelphia, Pa. App. filed Dec. 1, 1924.

1,653,879. ELECTROLYTIC CELL; West Orange, N. J. App. filed Oct. 22, 1924.

1,653,895. HIGH TENSION CABLE JOINT AND METHOD OF MAKING THE SAME; L. Emanueli, Milan, Italy. App. filed Nov. 19, 1926.

1,653,941. ELECTRICAL SWITCH; C. A. Brown, Lorain, O. App. filed March 8, 1926. Wherein it is desired to operate a set of electrical contacts quickly, so that sparking at the contacts will be reduced.

1,653,946. ELECTRIC STEP BY STEP MOTOR; H. Clausen, Cricklewood, London, England. App. filed June 13, 1924.

New Trade Literature

HYDRAULIC PUMPS AND MOTORS.—The American Fluid Motors Company, Philadelphia, is distributing a catalog on Hele-Shaw hydraulic pumps and motors. This catalog describes and illustrates the application of high-pressure hydraulic power on a variety of machinery drives, including presses, broaching machines, testing machines, cranes, mechanical stokers and a wide variety of other heavy machinery.

AUTOMATIC SWITCHING EQUIPMENTS, METERS AND RELAY.—Bulletins GEA-189A, GEA-862 and GEA-859, issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively the automatic switching equipments for indoor alternating-current reclosing feeder service; types M-5 and M-12 direct-current, indicating demand meters; and type PD-3 current differential relay.

LOW-TEMPERATURE COAL DISTILLATION.—Catalog KSG-2, issued by the International Coal Carbonization Company, 200 Madison Avenue, New York City, a subsidiary of the International Combustion Engineering Corporation, covers the KSG process for the low-temperature carbonization of coal.

OUTDOOR STATION EQUIPMENT.—Bulletin GEA-748A, issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the G-E bus supports for outdoor service, the G-E standard pin-type insulators, the separable post-type insulators and connectors and fittings for tubular conductors.

ELECTRIC FANS.—The Robbins & Myers Company, Springfield, Ohio, has issued its miniature fan catalog No. 1355 for 1928 covering the various types of "R&M" desk, wall and ceiling fans.

WIRE AND WIRE PRODUCTS.—The Hoffman Publications, Inc., 471 Fourth Avenue, New York City, has issued a leather-bound 1928 edition directory, index and buyers guide on wire and wire products.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Sydney, Australia (No. 28,823), for small and medium size electric motors, and another (No. 28,824) for fractional horsepower motors.

An agency is desired in Wellington, New Zealand (No. 28,822), for electric ranges.

Purchase is desired in Leghorn, Italy (No. 28,771), of commercial electric refrigerators.

Purchase is desired in Auckland, New Zealand (No. 28,851), of electric fixtures and appliances.

Purchase is desired in Meiningen, Germany (No. 28,848), of floor-polishing and scrubbing machines and vacuum cleaners.

Purchase is desired in Colon, Panama (No. 28,852), of small floor-tile polishers.

An agency is desired in Vienna, Austria (No. 28,882), for portable electric tools.

Purchase is desired in Montreal, Canada (No. 28,853), of immersion water heaters.

Purchase is desired in Johannesburg, South Africa (No. 28,942), of hand and miners' electric lamps, flash-light cases and railway warning signals.

Purchase is desired in Prague, Czechoslovakia (No. 28,943), of traffic control signals.